PDEase 

Macsyma and PDEase *Scientific Notebook Interface Reference Manual*

September, 1998

Macsyma Inc.
20 Academy Street
Arlington, MA 02476/USA

tel. 781-646-4550
fax: 781-646-3161
info@macsyma.com

1-800-macsyma
1-800-622-7962
http://www.macsyma.com

This document corresponds to Macsyma Version 2.3 and PDEase2D Version 3.01.

A report or thesis that contains results obtained by using Macsyma should acknowledge that the work was done with the aid of Macsyma, a large symbolic manipulation program currently developed and maintained by Macsyma Inc. of Arlington, MA.

A copy of the report or thesis should also be sent to Macsyma Inc.

The Documentation Staff of Macsyma Inc. prepared this manual.

ISBN: 1-8910060-18-5

Macsyma Inc.
20 Academy Street
Arlington, MA 02476-6436
Tel: 781-646-4550
1-800-MACSYMA
Fax: 781-646-3161

URL: http://www.macsyma.com

Printing History: 98 2

Contents

Preface

For over twenty-five years, industrial, government and academic users spanning disciplines from pure and applied mathematics to engineering and scientific fields, have found Macsyma® to be the first and most reliable technical computing environment. Now, with MFE (Macsyma Front End), you can use this powerful notebook interface to the Macsyma and PDEase math engines for symbolic and numeric computation, solving partial differential equations, data analysis, scientific visualization, and animation. You can combine mathematics, formatted text, and beautiful 2D and 3D graphics seamlessly in presentation quality notebooks, as well as link them together or link them to the Internet.

MFE notebooks merge text and graphics processing, allowing you to create documents with commands, input and output, as well as graphics, text, and data. The notebook interface helps any user who needs to create technical documents. In fact, you can cut and paste sections of Macsyma notebooks into Microsoft Word or PowerPoint documents. Or you can create interactive technical documents by combining the text and math engines in a single notebook. If you currently use Word, you will find most of the notebook conventions familiar. Every Macsyma or PDEase user can create interactive technical documents linked together with hypertext for:

- Electronic textbooks, class notes or homework
- Project design notebooks
- Archival scientific or engineering notebooks
- Reports and presentations
- Internet applications

This manual explains how to use MFE with the Macsyma and PDEase math engines. It describes the menus, buttons and toolbars, the interactive online help, the innovative DataViewer™, the MathHelp™ and MathTips™ systems, and the settable attributes.

Documentation Set

Note: *Information in this manual is subject to change. Always review your Release Notes and on-line readme files for the most recent and accurate information.*

The Macsyma documentation set includes:

- *Macsyma Quick Reference Card*
- *Macsyma User's Guide*
- *Macsyma Mathematics and System Reference Manual*
- *Macsyma and PDEase Notebook Interface Reference Manual*

- *Scientific Graphics Reference Manual*

plus online help including:

- Mathematical topic menus
- 700+ function templates
- 900+ executable examples
- 200+ executable demonstrations
- MathTips™ functional index
- *Introduction to Macsyma* online help

The PDEase2D documentation set includes:

- *PDEase2D Reference Manual*
- *Macsyma and PDEase Notebook Interface Reference Manual*

plus online help including:

- PDEase browser
- 140+ executable examples
- 140+ MFE notebooks with PDEase output and graphics
- PDEase samples search facility
- PDEase contents index
- *Introduction to PDEase2D* online help

Conventions

-  indicates the information in a section is specific to Macsyma.
-  indicates the information in a section is specific to PDEase.

For More Information

For information about getting started with Macsyma, read the *Introduction to Macsyma* accompanying your Macsyma in print or on the CD-ROM, or the first chapter in the *Macsyma Mathematics and System Reference Manual*, which tells you how to enter and exit the program. For information about using PDEase, refer to the PDEase 3.0 Manual or the *Introduction to PDEase2D* on the CD-ROM.

Technical Support

For technical support, contact Macsyma at:

- service@macsyma.com
- 781-646-4550
- http://www.macsyma.com.

Chapter 1. About MFE

1.1. What is MFE?

MFE (Macsyma Front End) is your interface to Macsyma and PDEase.

- It displays one or more Macsyma notebooks at the same time.
- It allows you to customize notebook attributes affecting text and graphics.
- It provides online help facilities.
- It provides a DataViewer™ in which you can view numerical data or export to files.
- It provides an MFE math engine, which is separate from the Macsyma and PDEase math engines. For more information, see *Chapter 8. The MFE Math Engine*, page 97.

The Macsyma math engine is the main Macsyma mathematics application program. It is a separate application from MFE. MFE sends the commands from each Input section in a notebook to the Macsyma math engine for processing.

The PDEase math engine is also a separate application from the Macsyma math engine and MFE. MFE sends commands from a PDEase Script section to the PDEase math engine for processing.

You can view a notebook by starting MFE without starting a Macsyma or PDEase math engine. To do so, click on the MFE program item or shortcut.

The status bar at the bottom of the MFE window displays information about the current status of Macsyma, such as whether a Macsyma or PDEase math engine is connected to the current notebook and when you can execute the next command.

MFE variables, local to each notebook, control the facilities for importing or exporting data in the local file system, for viewing data, for graphing, and for exchanging data between MFE and the Macsyma math engine. For more information, see *2.5.3. DataViewer™ Section*, page 8. The PDEase math engine typically uses MFE variables for notebook display.

Chapter 2.
About Notebooks

2.1. In This Chapter

2.2. What is a Notebook?

MFE has a notebook style interface. A notebook is an executable online document that contains formatted text, input command lines and scripts, mathematical output expressions, editable graphics and tabular data displays. You input and edit in a linear text format. The system displays mathematical output in a textbook quality 2-dimensional graphical format. 2D and 3D graphics and data are displayed appropriately. Any notebook you create can be saved and opened at a later time. Each notebook consists of one or more of the following sections: Input, Output, Graphics, DataViewer, Text, Interaction (Macsyma and/or PDEase), Batch and Metafile. Sections of one major type can contain subsections of another type. Major sections have a red outer border on the right, while interior sections have red inner red borders.

The notebooks shown in Figure 1 and Figure 2 on the next page contains two major sections. The first major section contains three minor Text sections. The second major section contains a single Macsyma Input section, with the line (c1). The currently selected section is the third Text section in the first major section. It is outlined in red and contains one line of formatted text. Note: a single notebook can contain both Macsyma and PDEase sections.

Notebooks also have dynamic button bars that change with the type of the currently section. For example, math input sections offer buttons for Macsyma math templates. Graphics sections offer buttons for modifying graphics.

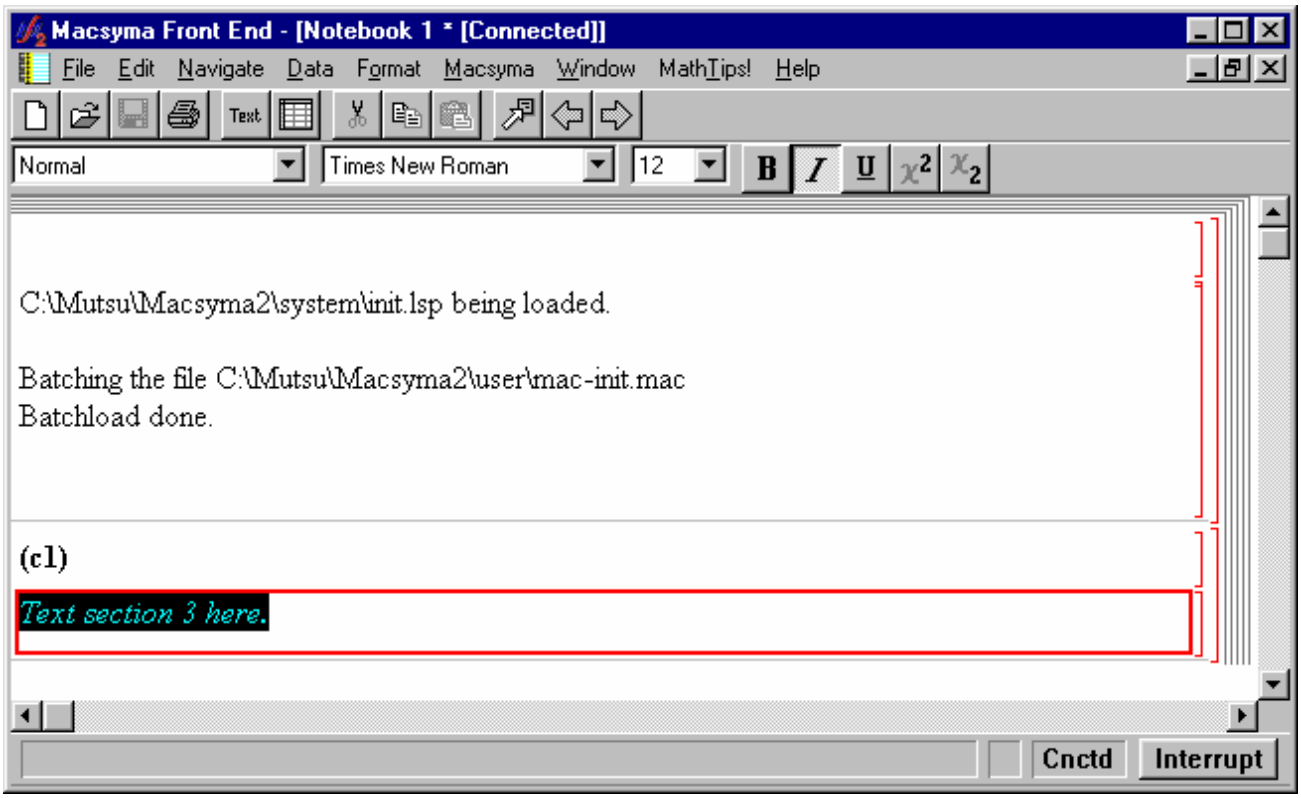


Figure 1 Macsyma Notebook with text section selected

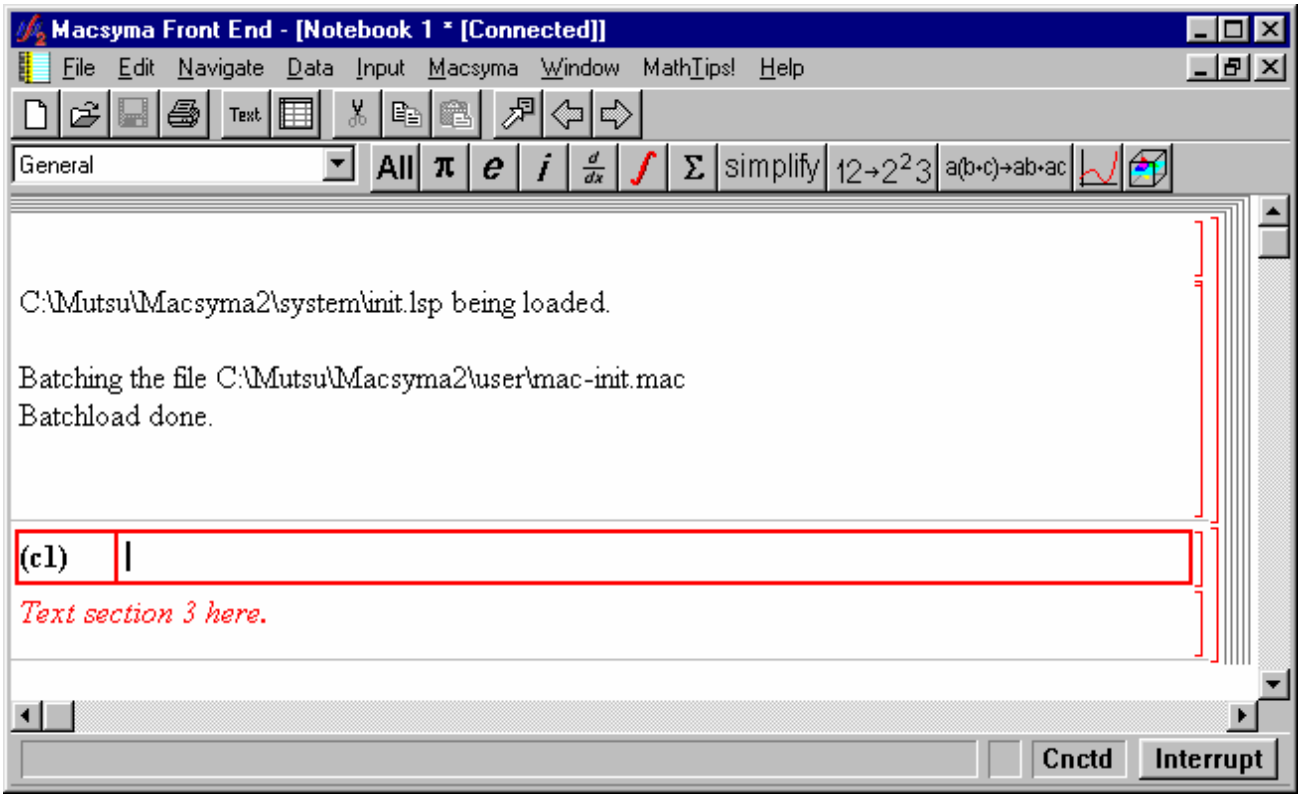


Figure 2

2.3. Macsyma Sections

The following sections can be used in the Macsyma sections of a notebook:

- *2.3.1. Input Sections*
- *2.3.2. Output Sections*
- *2.3.3. Interaction Sections*

For information about sections that pertain to both Macsyma and PDEase, see *2.5. Common Sections*, page 7.

2.3.1. Input Sections

A Macsyma Input section contains a command that you can send to the Macsyma math engine. Each command is denoted by a label c#, where "#" is an integer.

2.3.2. Output Sections

A Macsyma Output section contains output from a Macsyma command executed in the corresponding Input section. Each output display line is denoted by the label \typed{(d\#)} (or \typed{(e\#)} for intermediate output) where " \# " is an integer. To edit the appearance of math expressions:

- Click *Edit-Section Properties* in a selected Input or Output section.
- Click *File-Options* and select Math in all Input and Output sections in the current notebook.
- Click *File-Option Defaults* and select Math to set defaults in Input and Output sections in all future notebooks,

See *7.3. Math Attributes*, page 72, for a list of the display aspects you can change. See 4.18. Formatting Text, page 45, for an overview of how to change font attributes.

2.3.3. Interaction Sections

A Macsyma Interaction section groups an Input section with any associated Output and/or Graphics sections. You can cut, copy and paste an Interaction section as one unit or manipulate constituent sections separately. You can insert an empty Interaction section by clicking *Edit-Insert Section* and drag an Input section into the empty Interaction section.

2.4. PDEase Sections

You can use the following sections in the PDEase sections of a notebook:

- *2.4.1. Script Sections*

For information about sections that pertain to both PDEase and Macsyma, see *2.5. Common Sections,* page 7.

2.4.1. Script Sections

Input to the PDEase math engine is contained in a PDEase SCRIPT, which is created by a PDEase INTERACTION section. It is based on a TEXT section and has the same formatting capabilities.

2.4.2. Output Sections

The only Output section unique to PDEase contains notifications generated by the PDEase math engine while executing a script. The PDEase math engine also generates Graphics and DataViewer sections. For more information, see *2.5.2. Graphics Sections,* page 8, and *2.5.3. DataViewer™ Sections,* page 8.

2.4.3. Interaction Sections

A PDEase Interaction section contains all of the input and output associated with a PDEase script. Access a script click *File-Open* to open an existing .PDE file, or click *Edit-Insert Section-PDEase Interaction Section* to create a new one. When you select a PDEase Interaction section, a PDEase menu and the following toolbar buttons appear:

- PDEase button: Executes the commands in the PDEase Interaction section.
- Erase button: Erases all Output and Graphics sections produced during PDEase command execution.
- Pause button: Temporarily stops the execution of PDEase commands; continue the calculation by clicking Resume.

Here is a PDEase Interaction section containing the sample problem vibrabar.pde:

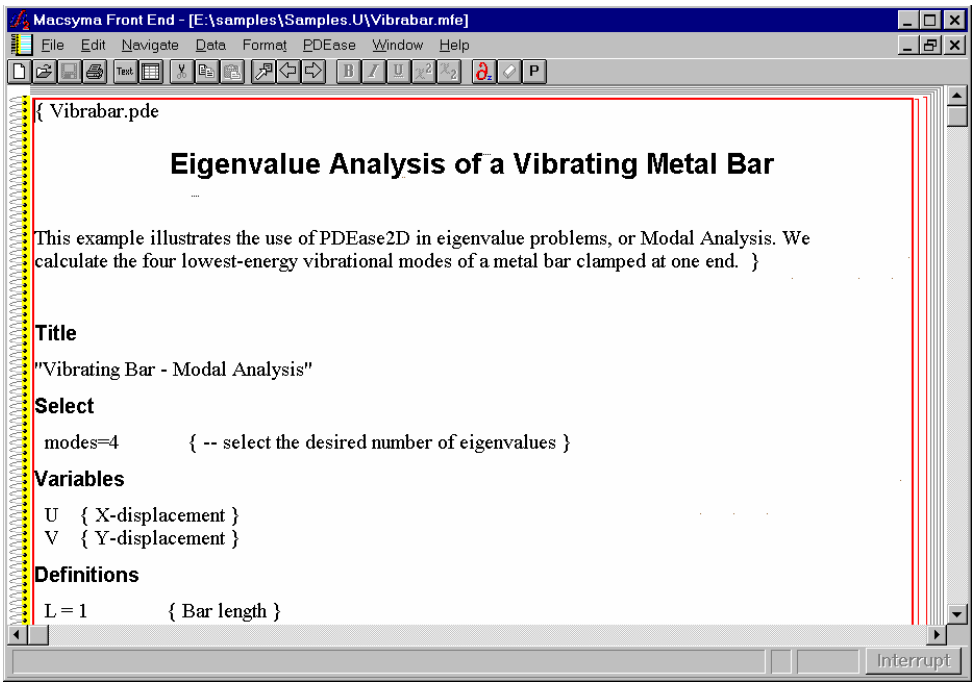


Figure 3 Macsyma Notebook with PDEase2D Section

2.5. Common Sections

You can use several types of notebook sections in both Macsyma and PDEase:

- *2.5.1. Text Sections*
- *2.5.2. Graphics Sections*
- *2.5.3. DataViewer™ Sections*
- *2.5.4. Metafile Sections*

2.5.1. Text Sections

Formatted Text sections have no impact on mathematical computations. Insert an empty Text section by clicking *Edit-Insert Section-Formatted Text* or by clicking the Text toolbar. By default, Text sections appear *after* the current section.

2.5.2. Graphics Sections

A Graphics section contains a graphic image, usually one produced by the preceding Input section. You can cut or copy Graphics sections and paste them anywhere in a notebook.

2.5.3. DataViewer™ Sections

A DataViewer section contains a tabular display of data which you can import, export, edit, graph, and pass to and from the Macsyma math engine.

> ***Note:*** The MFE math engine is separate from the Macsyma math engine, and each has its own set of variables.

Create an empty DataViewer section by clicking *Edit-Insert-DataViewer* or create a new DataViewer section to view an existing MFE variable by clicking *Data-View* or pressing the Data toolbar button and selecting the data you want. You can also use the Macsyma math engine command view_mfe_data (see **view_mfe_data** page *36)*, By default, DataViewer sections appear *after* the current section.

If no MFE variables exist, create one by:

- Using the mfe_put command (see page 97.
- Importing data from a file. See *4.6. Data* Menu, page 31.
- Assigning the data from an existing graphics section. See *4.15. Graphics Menu*, page 41.

Use the pull-down menu to edit DataViewer section attributes.

2.5.4. Metafile Sections

A Metafile section contains a metafile pasted from another application. When you have a metafile on the Windows clipboard, insert it by clicking *Edit-Paste Metafile.* By default, the metafile appears at full width and height. Change the height by dragging the top or bottom edge of the section. After you select a Metafile section, you can position the image and turn isotropic scaling on or off.

2.5.5. Batch Sections

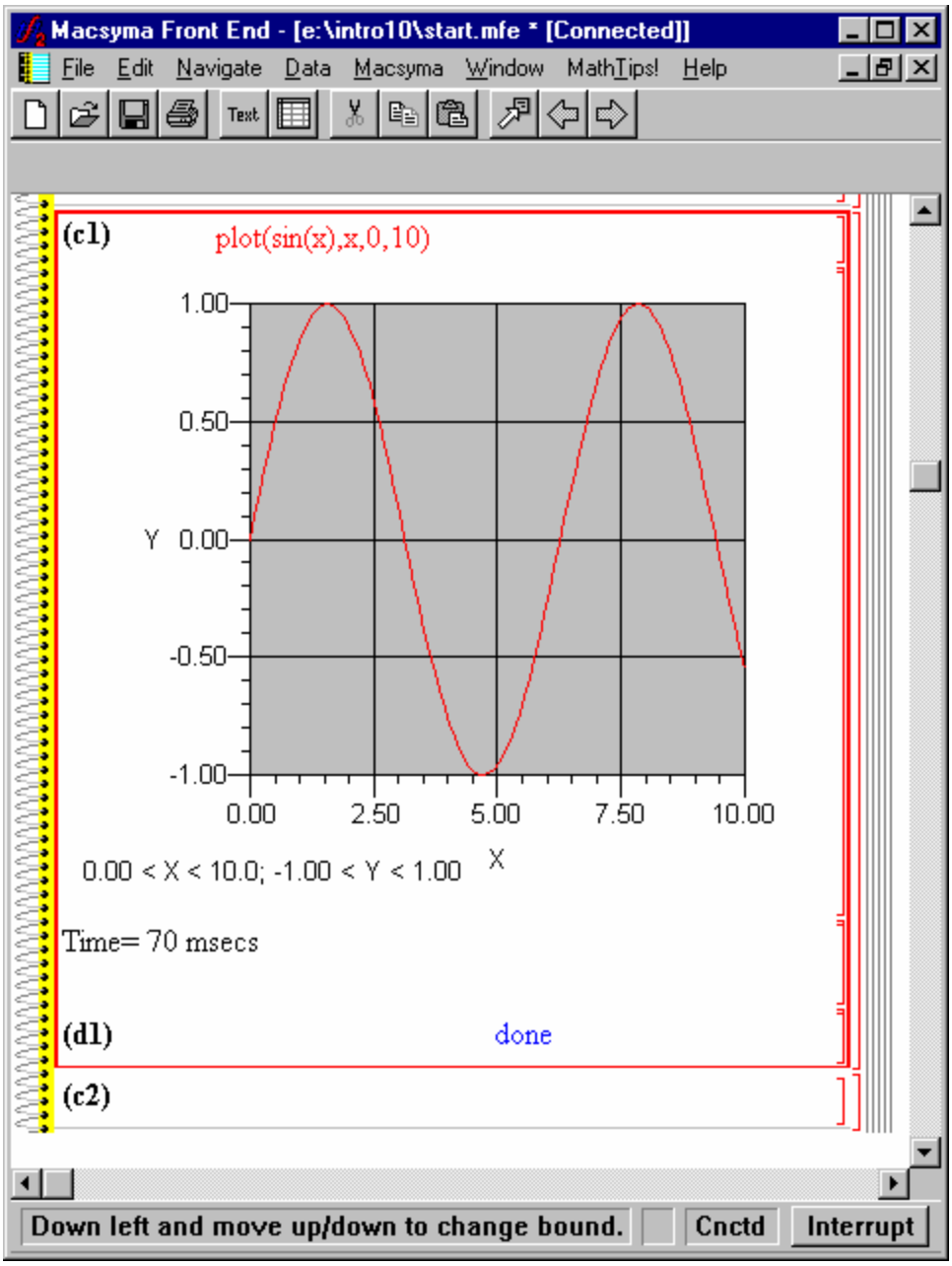
A Batch section contains notebook information and batch options. Use the Batch facility to start Macsyma or PDEase Math engines to batch execute the notebooks you have specified. They will execute sequentially; a new math engine starts for each batch section. See Section 4.12. Batch Menu.

2.6. Collapsible Sections

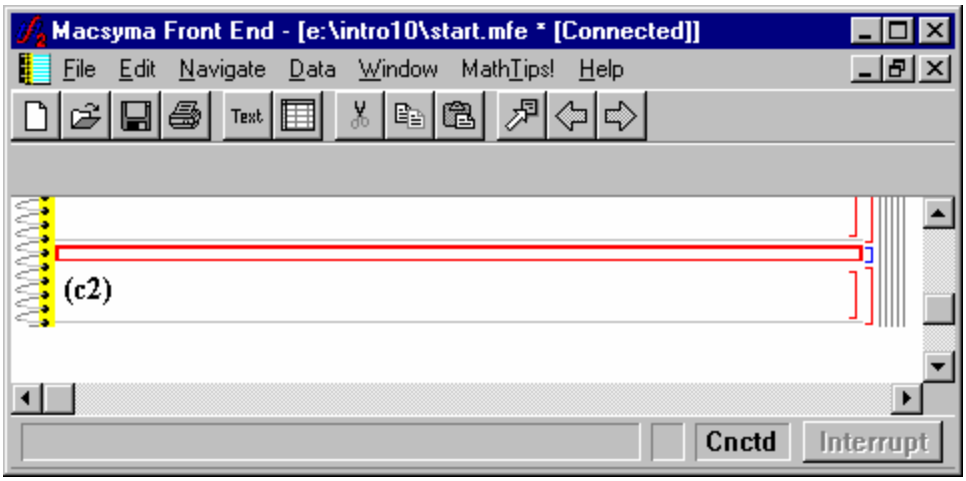
Notebook sections are collapsible. You can select a single section or a group of sections and collapse them into a container by clicking on Edit – Collapse Section. The section bracket changes color and any remaining visible text changes font to indicate a collapsed section.

You can restore a collapsed section by clicking on Edit – Restore collapsed section.

For example, if you start with a notebook like



where three sections have been selected with a single container section marked on the left section bracket, you can collapse them by using Edit –Collapse to change to your notebook to look like:



The section bracket changes color to indicate collapsed sections. If text is present in the first line of the first collapsed section, the text changes font as well.

You can collapse sections in a Macsyma notebook as well as sections in a PDEase notebook.

Chapter 3.
Basic Notebook Operations

3.1. In This Chapter

3.2. Opening and Closing Notebooks

The MFE window can hold several open notebooks at once, allowing you to move materials from one notebook to the other. You can:

- Open a new empty notebook. See *File-New,* page 25.,
- Connect a notebook to the Macsyma math engine. See *Macsyma-Connect,* page 25.
- Save a notebook. See *File-Save* or *File-Save As,* page 25.
- Reopen a saved notebook. See *File-Open,* page 25.
- Close a notebook by clicking the small rectangle in the upper left corner of the notebook and selecting *Close*.
- Close a notebook by selecting *File-Close.* See *File-Close,* page 26.

3.3. Connecting to Math Engines

3.3.1. Connecting to Macsyma

The word “connected” appears in the MFE title bar when a notebook is connected to a Macsyma math engine. To connect a notebook, click *Macsyma-Connect* and choose a running math engine or start a new engine. If a Macsyma math engine is already running and connected to another notebook, use that engine. (Running two Macsyma math engines at the same time requires a lot of memory).

To disconnect a notebook, click *Macsyma-Disconnect*.

For information about MFE attributes that affect the interaction of the Macsyma math engine and MFE see:

- *Notebook: Math Engine Auto Start, page 71.*
- *Notebook: Math Engine Maximize on Autostart, page 71.*
- *Notebook: Win: Hide Math Engine, page 71.*

3.3.2. Connecting to PDEase

Select a PDEase Interaction or Script section in your notebook to connect to a PDEase engine,. Use *File-New* to create a new notebook from the PDEase template or open an existing notebook with *File-Open*. The PDEase, Erase, and Pause buttons will all appear on the toolbar. Connect to the PDEase math engine by clicking on the PDEase button or choosing *PDEase-Execute*. The PDEase math engine disconnects automatically after execution.

3.4. Moving Within and Between Notebooks

3.4.1. Selecting Notebook Sections

Click anywhere inside a notebook section to select it. Selected sections are highlighted with a red box. To select multiple sections, press Ctrl+Click in the sections. To select a range of sequential sections, click in the first section, then press Shift+Click in the last section. To select all sections of a given type, or all sections in a notebook, click *Edit-Select* (see *4.4. Edit Menu*, page 27). Once you have selected a section, you can cut, copy, paste, delete, and move it with the Edit menu, toolbar buttons, or keyboard shortcuts. See *Section 3.4.2. Moving Around with Keyboard Shortcuts*.

3.4.2. Moving Around with Keyboard Shortcuts

Use keyboard shortcuts to speed up marking, cutting, pasting, and moving text and objects to and from the clipboard.

- *3.4.2.1. Gestures Which Affect Text Sections*
- *3.4.2.2. Gestures Which Affect Input Sections*
- *3.4.2.3. Gestures Which Affect Graphics Sections*
- *3.4.2.4. Gestures Which Affect All Notebook Sections*

3.4.2.1. Gestures Which Affect Text Sections

Key Combination	Description
⇧ / ⇩	Move up/down 1 line if possible.
Alt+⇧ / Alt+⇩	Move up/down 1 section.
⇦ / ⇨	Move left/right 1 character. (Also hold shift key to mark text.)
Ctrl+⇦ / Ctrl+⇨	Move left/right 1 word. (Also hold shift key to mark text.)
Ctrl+⇧ / Ctrl+⇩	Move up/down 1 paragraph if possible. (Also hold shift key to mark text.)
Home	Moves cursor to beginning of current line.
Ctrl-Home	Moves cursor to beginning of current text section.
End	Moves cursor to end of current line.
Ctrl-End	Moves cursor to end of current text section.

3.4.2.2. Gestures Which Affect Input Sections

Key Combination	Description
Ctrl-O	Grab contents or selected text from the most recent selected input section and place it in the input section for the next command.
Ctrl-U	Clear all contents from selected input section.
⇧ / ⇩	Move up/down 1 line if possible.
Alt+⇧ / Alt+⇩	Move up/down 1 section.
⇦ / ⇨	Move left/right 1 character. (Also holding shift key marks text.)
Ctrl+⇦ / Ctrl+⇨	Move left/right 1 word. (Also holding shift key marks text.)
Ctrl+⇧ / Ctrl+⇩	Move up/down 1 paragraph if possible. (Also
Home	Moves cursor to beginning of current input section. (Also hold shift key to mark text.)
End	Moves cursor to end of current input section. (Also hold shift key to mark text.)
Shift-Enter	Introduces a line feed, without submitting for execution.
Ctrl-Enter	Submits the contents of the current input section for execution by the Macsyma engine; does not print the resulting value.
Enter	Submits the content of the current input section for execution by the Macsyma math engine; displays the resulting value on an output line.
Pause	Introduces a new input section in the notebook.

3.4.2.3. Gestures Which Affect Graphics Sections

Key Combination	Description
Shift-Mouse-Left	Selects the current point in a 3D plot as the center point for rotations and zoom.

With Scroll_Lock Off:

⇧ / ⇩	Rotate viewing camera up or down.
Shiftt+⇧ / Shift+⇩	Rotate viewing camera up or down with a larger angle
⇦ / ⇨	Rotate viewing camera left or right.
Ctrl+⇦ / Ctrl+⇨	Move left/right 1 word. (Also hold shift key to mark text.)
Ctrl+⇧ / Ctrl+⇩	Move up/down 1 paragraph if possible.

Key Combination	**Description**
Arrow	Rotates the viewing camera left, right, up and down. (Also hold Shift to increase rotation angle.)
With Scroll_Lock On:	
Arrow	Translates the viewing camera left, right, up and down. (Also hold Shift to increase step size.)

3.4.2.4. Gestures Which Affect All Notebook Sections

Key Combination	**Description**
Alt-Arrow	Moves cursor with up and down arrows to the notebook section immediately above or below the currently selected section. Left and right arrows do nothing.
Backspace	Deletes the character immediately to the left of the cursor.
Page-Up	Scrolls the entire notebook to view previous sections.
Page-Down	Scrolls the entire notebook so you can view later sections.
F1	Finds help topic for word on which the cursor is positioned. (Uses Macsyma engine help, not Front End Help.)
Delete	Deletes the character immediately to the right of the cursor or deletes the currently selected text.
Shift-Delete	Deletes the currently selected notebook section(s).
Ctrl-C	Copies the currently selected text or notebook section to the clipboard.

Ctrl-X	Deletes the currently selected text or notebook section.
Ctrl-V	Pastes the clipboard contents into the currently selected notebook.
Del	Delete forward 1 character.
Backspace	Delete backwards 1 character.

Key Combination	Description
Page Up/Page Down	Scroll up/down.
Shift+Page Down	Same as Page Down/Up (scrolling).
⇧ / ⇩	Move up/down 1 line if possible.
Alt+⇧ / Alt+⇩	Move up/down 1 section.
⇦ / ⇨	Move left/right 1 character.
Ctrl+⇦ / Ctrl+⇨	Move left/right 1 word.
Ctrl+⇧ / Ctrl+⇩	Move up/down 1 paragraph if possible.
Home/End	Move to beginning/end of line.
Ctrl+Home/End	Move to beginning/end of section.
Shift+Home/End	Highlight from point to beginning/end of section.
Shift+⇨ / Shift+⇦	Highlight, from point right/left 1 character.

3.4.3. Notebook Hypertext

MFE supports hypertext linking from a Text section to another section of the current notebook or any other notebook.

- *3.4.3.1. Creating and Editing Hypertext Links*
- *3.4.3.2. Using Hypertext Links*
- *3.4.3.3. Editing the Appearance of Active Text*
- *3.4.3.4. Relative Paths for Hypertext Links*

3.4.3.1. Creating and Editing Hypertext Links

To create a hypertext link, mark the text you want to be "active" and click *Format-Create Link* (see *4.14. Format Menu,* page 39) to open the *Choose Section* Dialog, where you select a link target. *See 6.2. Choose Section Dialog,* page 57. You can designate the target section by contents or by naming it. For durable hypertext links, link by name. You can also link to any World Wide Web URL or any file with a known type Active text becomes an underlined in green.

You can edit the active text of a hypertext, change the link target by placing your cursor within the active text, and clicking *Format-Edit Link* or remove a hypertext link by selecting the active text and deleting it. See *4.14. Format Menu,* page 39.

3.4.3.2. Using Hypertext Links

When you move the pointer over active text, it changes to a pointing finger. You can edit the text or double-click to move to the link target. If the target is in the current notebook, the notebook automatically scrolls to that section and selects it. If the target section is in another notebook, that notebook is opened, brought to the front, and the section is selected. If the target is a URL, your default browser will open the URL. If the target is a file, you must use the appropriate application to open the file.

3.4.3.3. Editing the Appearance of Active Text

The Font: Formatted Link Appearance attribute (an Expert Mode attribute) controls the font style and color. By default active text appears as underlined green. The type style automatically complements the character formatting of the local environment. If, for example, you create a link from underlined text, the linked text will not be underlined. You can also format text using standard character formatting commands. See also *4.14. Format Menu,* page 39, and *4.18.1. Font Controls,* page 45.

3.4.3.4. Relative Paths for Hypertext Links

You can specify absolute or relative pathnames for hypertext links. The relative pathname for a link target is stored relative to the path of the notebook containing the active link. Therefore, you can make a tree of interlinked notebooks using relative pathnames and move the tree anywhere in the file system hierarchy without changing the cross-notebook hypertext links, as long as the relative directory location between the starting notebook and the target notebook remains the same. To move a single notebook to a different place in the file system without moving the other notebooks, load the notebook to be moved, and save it in the new file location using *File-Save As.* See*4.2. File Menu,* page 25.

3.4.4. The Navigation Facility

You can see a summary of the contents or one or more open notebooks and move to any section. See *4.5. Navigate Menu,* page 30.

3.5. Re-Executing Notebooks w/Macsyma Sections

You can re-execute commands in a notebook using *Macsyma-Reexceute*. See *4.4. Edit Menu,* page 27.

- To re-execute an individual Input section, select the section and press Enter or *Macsyma-Reexecute*.
- To re-execute a group of Input sections, select them and click *Macsyma-Reexecute*.
- To re-execute an entire notebook:
  1. Set the attribute Notebook: Execute In Place On (in the *File-Options* or in the *File-Option Defaults* dialogs).
  2. Click *Edit-Select*, and choose *Input*.
  3. Click *Macsyma-Reexecute*.

If the notebook is connected to a Macsyma math engine, the engine will re-execute the commands in the selected Input sections. If the notebook is not connected, you can start a new engine or re-attach a math engine that is connected to a different notebook. Normally, you should use a Macsyma math engine that is already running.

When one or more Input sections are re-executed, replaceable sections are removed from the notebook until a

non-replaceable section or the end of the Interaction section is reached. New sections appear immediately after the re-executed Input section (the default) or at the end of the notebook. See also *Edit–Replaceable*, page 27, *Notebook: Execute In Place*, and *Notebook: Execute Watch*, page 71.

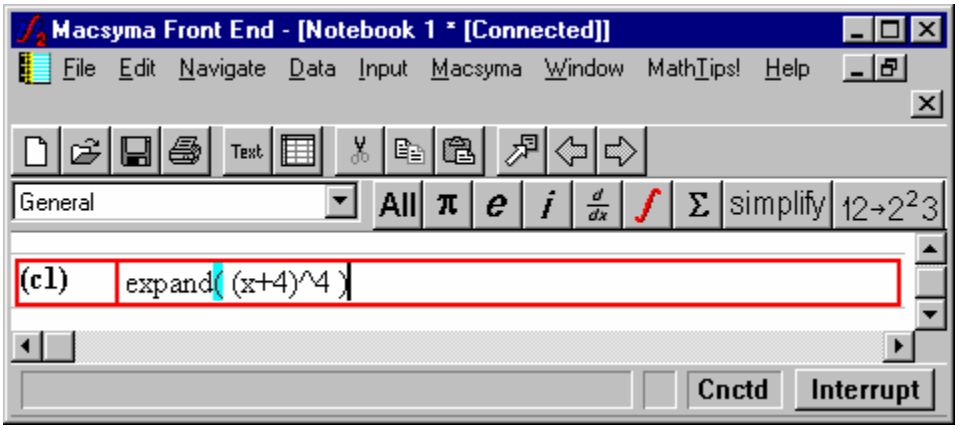
3.6. Changing the Appearance of Notebooks

- See *4.9. Output Menu*, page 36, to change the appearance of mathematical output.
- See *4.15. Graphics Menu*, page 41, to change the appearance of graphics in a notebook.
- See *4.14. Format Menu*, page 39, to change the appearance of formatted text.
- See *4.18. Formatting Text*, page 45, to change fonts in Text, Input, and Output sections.
- See *3.6.1. Matching Parentheses*, page 19, to change the color of matching parentheses in math mode.
- To change notebook decorations, click *File-Options* and select the Notebook category. See 7.2. Notebook Attributes, page 69 for a description of attributes you can change. In particular:
  - To remove notebook decorations, click *File-Options*, Category *Notebook*, and set Notebook: Border Enabled to Off. See *File-Options*, page 25.
  - To remove borders permanently, click *File-Option Defaults* and make changes there (instead of in *File-Options*). See *File-Options*, page 25.
  - To remove section brackets, click *File-Options*, Category *Notebooks*, and set Notebook: Section Bracket Enabled to Off. See 4.2. File Menu, page 25.

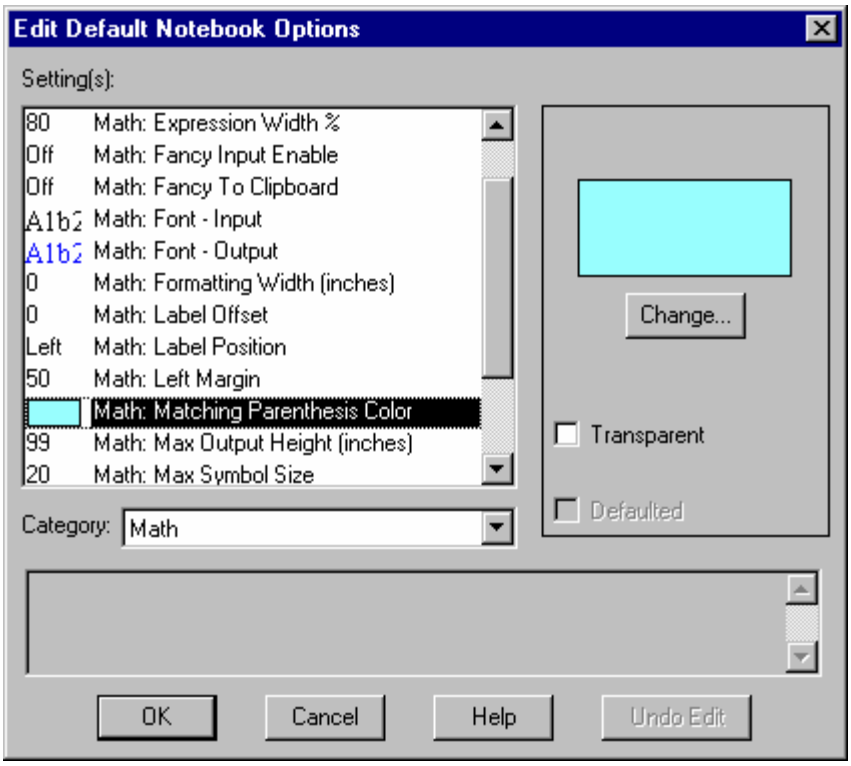
3.6.1. Matching Parentheses

Notebook highlights matching parentheses, brackets and braces in math input sections and PDEase interaction sections. This feature is particularly helpful for writing multi-line expressions and programs.

For example, matching parentheses are highlighted as



You can change the color of the highlight from the File – Options or the File – Options Default Menu, category Math



3.6.2. Converting Notebooks to TeX or LaTeX

WARNING: The contents of this section are subject to change without notice.

You can use File – Save As to save a notebook with the extension .tex. This will convert the contents of your notebook to standard TeX, keeping the layout of text sections, Math input and output sections, hypertext links, DataViewers and graphics. Graphics sections are converted to .GIF format.

You must use a color depth of 256 colors or less to successfully export GIF files.

DataViewers are converted to tables.

2D math output is “passed thru” as “dumb text.” However, you can also use Macsyma’s TeX and LaTeX commands to generate TeX for 2D math.

See Release Notes for your version of Macsyma for more information.

3.6.3. Converting Notebooks to HTML

WARNING: The contents of this section are subject to change without notice.

You can use File – Save As to save a notebook with the extension .htm. This will convert the contents of your notebook to standard HTML, keeping the layout of text sections, Math input and output sections, hypertext links, DataViewers and graphics. Graphics sections are converted to .GIF format.

You must use a color depth of 256 colors or less to successfully export GIF files.

DataViewers are converted to tables.

2D math output is “passed thru” as “dumb text.”

See Release Notes for your version of Macsyma for more information.

3.6.4. Converting Notebooks and Text Files

3.6.5. Converting Macsyma Batch Files to Notebooks

To convert a text file of Macsyma commands (called a Macsyma batch command file) to a re-executable notebook, either:

- Click *Macsyma-Make Notebook* and select the command file you want to convert. The input commands will appear in Input sections ready for execution, and comments will appear as Text sections (without the “/* … */” comment delimiters) in your current notebook. To execute the notebook, select the desired Input sections (or all sections containing the desired Input sections) and click *Macsyma-Reexecute*.
- Type the make_notebook command, which does the same thing as *Macsyma-Make Notebook*.

To execute a text batch command file and obtain an executed (and re-executable) notebook, you can either:

- Click *Macsyma-Batch File* and select the command file you want to execute. The input commands will appear in Input sections; comments will appear as Text sections (without the “/* … */” comment delimiters); output expressions will appear in Output sections.
- Type the batch command, which does the same thing as *Macsyma-Batch File*.

Note: Using the Macsyma Math engine to batch a group of Macsyma commands is different from using MFE’s Batch facility, which uses either the Macsyma or PDEase Math Engine to batch execute the notebook sections. See also Section 4.12. Batch Menu.

3.6.6. Converting PDEase Command Files to Notebooks

Use *File-Open* to read an existing .PDE file into MFE and create a PDEase section. Then save the notebook as a Macsyma notebook with extension .MFE. Execute the PDEase commands by pressing the PDEase button or

clicking *PDEase-Execute*. Output from the PDEase engine can be in the form of normal Graphics sections, DataViewer sections, or text files.

3.6.7. Converting Macsyma Notebooks to ASCII Text Files

You can convert a notebook to an ASCII text file.

- Macsyma: To convert an executable notebook to a command file, click *File-Save As* and use the extension .MAC or .TXT. If you save the notebook as a .MAC file, input commands are saved and contents of the Text sections are converted to comments. Output and graphics are not saved. If you save it as a .TXT file, output sections are also saved. *See Section 3.6.9. Converting Notebooks to Text Files Including Output*, page 22.

NOTE: Special formatting styles (*e.g.* tensors) and some graphics entities or DataViewers may be lost when you convert a notebook to ASCII text.

3.6.8. Converting Notebooks to PDEase Command Files

To convert an executable notebook to a .PDE command file, click *File-Save As* and give the file a .PDE extension. Input commands are saved and contents of the Text sections are converted into comments. Output and graphics are not saved.

When you save a section as a .PDE file, text sections appear in a PDEase comment {…}.

NOTE: special formatting styles and some graphics entities or DataViewers may be lost when you convert a notebook to ASCII text.

3.6.9. Converting Notebooks to Text Files Including Output

To keep a text record of input and output, click *File-Save As* and use a .TXT extension. Input expressions, output expressions, and text from the Text sections are all saved as text. (Note that output expressions are saved in one-dimensional string format. Open a writefile to save the output expressions in two-dimensional text form.) If you want to save graphics as text, use the Macsyma character plotting commands (char_plot, etc.) when you generate plots.

3.6.10. Saving Notebooks in Notebook Files

To save a notebook with all graphics, formatted text and notebook settings, click *File-Save As* and use a .MFE

extension.

Saving a notebook that has a graphics section with a nonviable camera or missing data can cause errors when later opening or loading the notebook. Be sure to remove such graphics sections before saving.

3.6.11. Converting an ASCII Text file to a Notebook with Batch Sections

MFE's batch processing facility for notebooks is separate from the Macsyma batch files described in *Section 3.6.5. Converting Macsyma Batch Files to Notebooks*.

You can create an ASCII text file, with the extension .MFB that contains lines like

```
Batch Batch Sections In ".\batch.mfe" (Close, Save)
Batch Macsyma Sections in ".\Job1.mfe" (Close, Save)
Batch PDEase2D Sections in ".\Job2.mfe" (Close, Save)
```

You can then create a notebook with extension .MFE with three batch sections by opening the above file as:

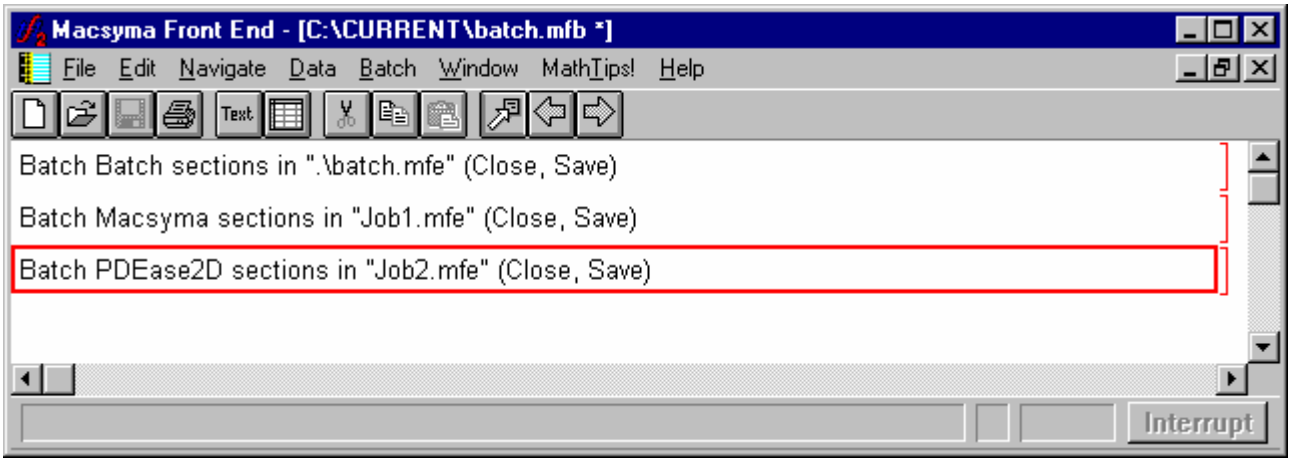


Figure 4 Notebook with Batch sections

Then save this notebook for later batch execution.

The Batch execution command starts a Macsyma Math engine and computes Macsyma input sections in Job1.mfe and starts a PDEase2D Math Engine and computes the PDEase sections of the notebook Job2.mfe. Batching is sequential. The entire process will terminate at any error. See *Section 4.12. Batch Menu*, page 38 for more information.

Chapter 4.
MFE Menus

4.1. In This Chapter

4.2. File Menu

The File menu lists operations that let you manipulate files containing Notebooks, Macsyma batch command files, or Macsyma text output files.

File Menu Item	Description

File Menu Item	Description
New	Opens new notebook with choice of Macsyma or PDEase templates.
Open	Opens a pre-existing notebook. Click *File-New.* (Shortcut: toolbar button.) You can open existing Macsyma demo notebooks from the Macsyma2\Demo directory or PDEase sample notebooks from the PDEase2D\Samples directory.
Close	Closes the current notebook.
Insert	Inserts a saved notebook into the current notebook. By default, it appears before the current selection. If no section is selected, the saved notebook appears at the end of the current notebook. See also *File-Open.*
Options	Controls various MFE attributes. Settings apply to the current and subsequent notebook. Attributes fall into five main groups: ■ *Notebook Attributes,* which affect the entire notebook, (i.e., notebook width, border decorations. ■ *Math Attributes,* which affect the appearance of math display in Input and Output sections. ■ *Graphics Attributes,* which define the appearance of graphics in notebooks. ■ *Print Attribute,* which control page margins, headers and footers, and page breaks. ■ *General Attributes,* such as the ability to turn *Expert Mode* on or off. You can select a group of attributes in the Options dialog. Changes are saved along with the notebook. See also *File-Option Defaults.*
Option Defaults	Lets you alter defaults for notebooks and the MFE window. These attributes apply to all notebooks (including previously created notebooks), except those notebooks and sections of notebooks for which you have explicitly set a particular attribute. See also *File-Options*.
Print	Prints the current notebook. Use the associated toolbar button or *File-Print Setup.* You can make postscript output of a graphic section or of the entire notebook by: 1. Installing a postscript printer driver, such as HP 4M Postscript, and configuring it to print to FILE. 2. Selecting the graphic, and printing the section to the printer. Windows will prompt you for the file location. You may need to adjust the printer defaults (*e.g.*, PS or EPS) page orientation, etc. Alternatively, you can use a program like GhostView to convert the file to EPS.
Print Setup	Selects a printer and sets printer options. See also *File-Options* and *File-Options Default.*
Save	Saves the currently selected notebook. (Shortcut: toolbar button.)
Save As	Lets you specify a file pathname and save the currently selected notebook. See also *File-Save*. You can save the notebook in six different formats with different extensions: ■ *filename*.MFE: Saves a complete re-executable notebook. ■ *filename*.MAC: Saves a Macsyma batch input file. All text is converted to a comment statement. Output and Graphics sections are not saved.

- *filename*.TXT: Saves a text version of the current notebook, including input and output. **Note:** Saving some math items to a text file when fancy_display is on can result in undesired results. For example, saving tensor quantities does not faithfully render the tensor when fancy_display is on, but does when fancy_display is false.
- *filename*.PDE: Saves a text version of the current notebook as a .PDE file. Output and graphics sections are not saved. Text sections are converted to PDEase style comments (include inside parentheses "{}").
- *filename*.TEX Saves an ascii file of TeX statements representing the current notebook. Graphics sections are converted to GIF format files, DataViewer sections are converted to tables, etc.
- *filename*.HTM Saves an ascii file of HTML statements representing the current notebook. Graphics sections are converted to GIF format files, DataViewer sections are converted to tables, etc.

File Menu Item	Description
Insert	Inserts an MFE file at the default location. Does *not* apply the style sheet of the existing notebook to the new MFE file. The notebook adopts any new styles the new MFE file brings with it.
Reapply Style Sheet	Re-applies the current style sheet to the current notebook. See *4.18.2. Text Styles, Style Sheets and Templates*, page 46.
Save Layout	Saves the size and screen location of windows and dialogs.
Security Keys	Requests Registered User information. Use to change user name or product version or to enter additional product keys
Most Recently Used	Contains a list of the most recently used notebooks or files.
Exit	Terminates MFE and any math engines.

4.3. Metafile Menu

A Metafile section contains a metafile that has been pasted from another application. When you have a metafile on the clipboard, you can insert it by clicking Edit-Paste. By default, the metafile appears full width and height. Alter the height by dragging the top or bottom edge of the section. When you select a Metafile section, a menu appears which allows you to align the image and turn isotropic scaling on or.

4.4. Edit Menu

The Edit menu options change depending upon the type of the selected notebook section.

Edit Menu Item	Description
Clear Notebook	Clears the currently selected notebook. See also *Edit-Delete Section* and *Edit-Select*.
Insert Section	Places a new section after the current selection. (To position the new section before the current section, press Shift while inserting.) If no section is selected, the

new section appears at the end of the notebook. (Press Shift to put it at the beginning.)

An inserted section can be a formatted Text section, expression Input section, DataViewer section, or interaction section that groups multiple sections.

Edit Menu Item	Description
Cut/Cut Section	Cuts selected text or notebook sections. (Shortcut: toolbar button.) MFE detects when to convert the cut section to a metafile.
Copy/Copy Section	Copies the selected text to the clipboard. (Shortcut: toolbar button). Applying these operations to a section of a notebook cuts, copies, or pastes the entire section, not just selected text.
Find	Searches forwards or backwards for a string of text. Highlights the found text. *Find* does not take formatting into account. The Find Dialog looks like: 
Find Next	Finds next instance of a text string. (Shortcut: F3 key.)
Paste/Paste Section	Pastes text or metafile from the clipboard into the notebook at the cursor location. (Shortcut: toolbar button.)
Paste and Execute	Pastes and executes a previously cut or copied Input section.
Delete/Delete Section	Deletes currently selected Text or Notebook section.
Clear Notebook	Deletes the current Notebook sections. If the notebook is connected to a Macsyma math engine, an empty Input section appears in an Interaction section in the notebook. See also *Edit-Delete Section* and *Edit-Select.*
Page Break After	Inserts a page break after the currently selected section.
Section Properties	Modifies properties of the current selection, including fonts, section width, and maximum section height. The available properties depend on the type of section. To edit attributes for an entire notebook, see also *File-Options*, page 25.
Reexecute	Re-executes the currently selected Input section. The accelerator key Enter is equivalent to *Macsyma-Reexecute* but only for re-executing a single Input section. To re-execute part or all of a notebook, see *3.5. Re-Executing Notebook*, page 18.
Remove Character Formatting	Removes formatting from the selected text.

Edit Menu Item	Description
Replaceable	Makes the selected notebook section replaceable (if checked) or non-replaceable (if not checked) while an Input section is re-executing. Each notebook section is marked "replaceable" or "not replaceable" during re-execution of the preceding Input section and a new Output section is inserted. All replaceable sections that appear after the re-executed Input sections are removed until the end of the Interaction section. See *Edit Menu Item Description* Each Input section is marked "not replaceable," and each Output and Graphics section is marked "replaceable," when it is created. Notebook sections display an extra tick mark at the upper edge of the right section bracket.
Section Properties	Changes the attributes of the currently selected Input, Output, or Text section without changing the attributes of other notebook sections. To change attributes for the entire notebook or to change the default attributes for all subsequent notebooks, see *File-Options*, page 25.
Select	Lets you select all Input, all Output, all Graphics, or all sections. This command is often used before executing, copying, or deleting a group of notebook sections. For more information on selecting a section in a notebook, see *3.4.1. Selecting Notebook Sections*, page 13.
Collapse	Collapses the currently selected section or sections. Collapsing sections may not be nested.
Expand Collapsed	Restores the collapsed section or sections.

4.5. Navigate Menu

With the Navigate menu you can view various summary forms of the contents of a notebook and jump to another location in the same or another open notebook. See also *3.4.3. Notebook Hypertext*, page 11.

Navigate Menu Item	Description
Goto	Opens the *Choose Section Dialog*, which displays a summary of all sections in the current notebook. From here, you can select and jump to a section.
Previous Section	Selects the section before the currently selected section.
Next Section	Selects the section after the currently selected section.
Back in History	Goes to and selects the previous selection before using Goto or a Notebook Hyperlink; also adds the section to a History list. **Note:** sections selected by clicking on *Previous* or *Next Section* are not included in the history.
Forward in History	After you have moved backward through a history of sections, use this command to move forward one section in the history. Lets you name a notebook section. You can refer to that name in the Goto Dialog and when you set up notebook hypertext links. See *3.4.3. Notebook Hypertext*, page 17, and *4.14. Format Menu*, page 39, for information about creating and editing hypertext links in a notebook.

4.6. Data Menu

The Data menu lets you perform data operations and exchange data with external files.

For example, suppose you have external data in an Excel spreadsheet:

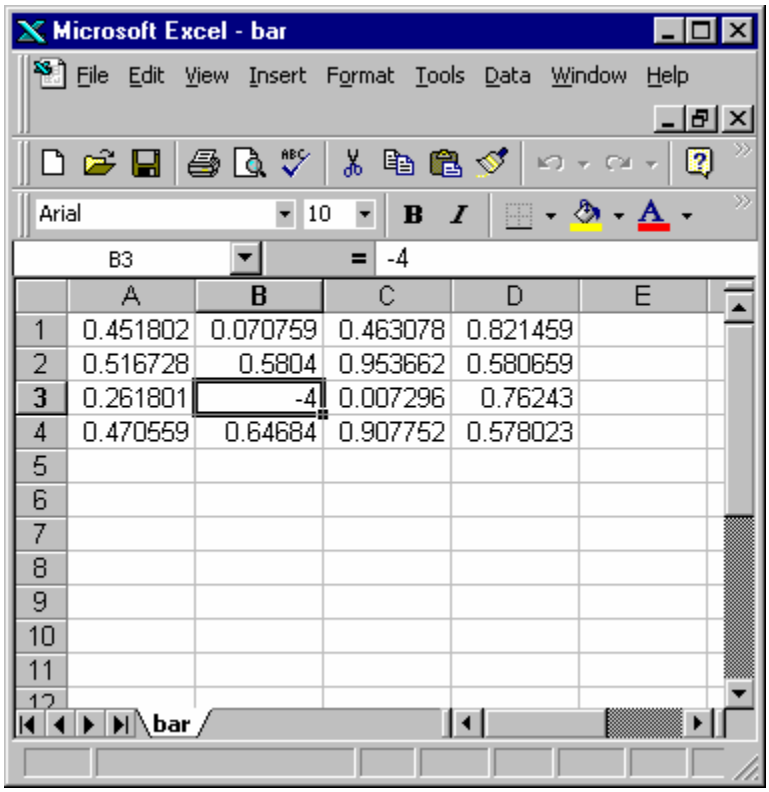


Figure 5 Excel notebook

You can store this data as a text delimited file (say bar.txt) which looks like

0.4518021,0.07075939,0.4630780,0.8214586

0.5167282,0.5804002,0.9536624,0.5806594

0.2618010,-4.000000,0.007295750,0.7624302

0.4705592,0.6468401,0.9077523,0.5780234

You can Import the data to an MFE variable with the *Data – Import* Dialog.

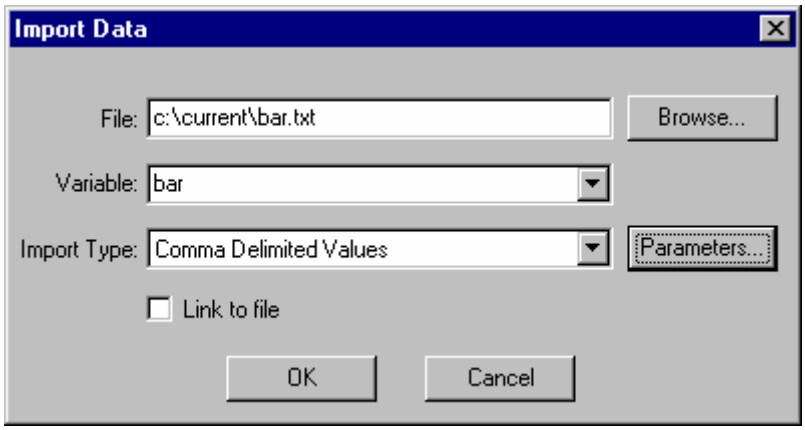


Figure 6 Import data dialog

And then examine the MFE variable bar in a DataViewer showing the first three columns.

bar	0	1	2
0	0.4518021	0.07075939	0.463078
1	0.5167282	0.5804002	0.9536624
2	0.261801	-4.	0.00729575
3	0.4705592	0.6468401	0.9077523
4			
5			
6			

Figure 7 DataViewer

Note: the number type of the first entry of the first line sets the type of numbers. The input file

1,2,3.33,4.44
1.11,2.22,3.33,4.44

will import as “integer” and appear as

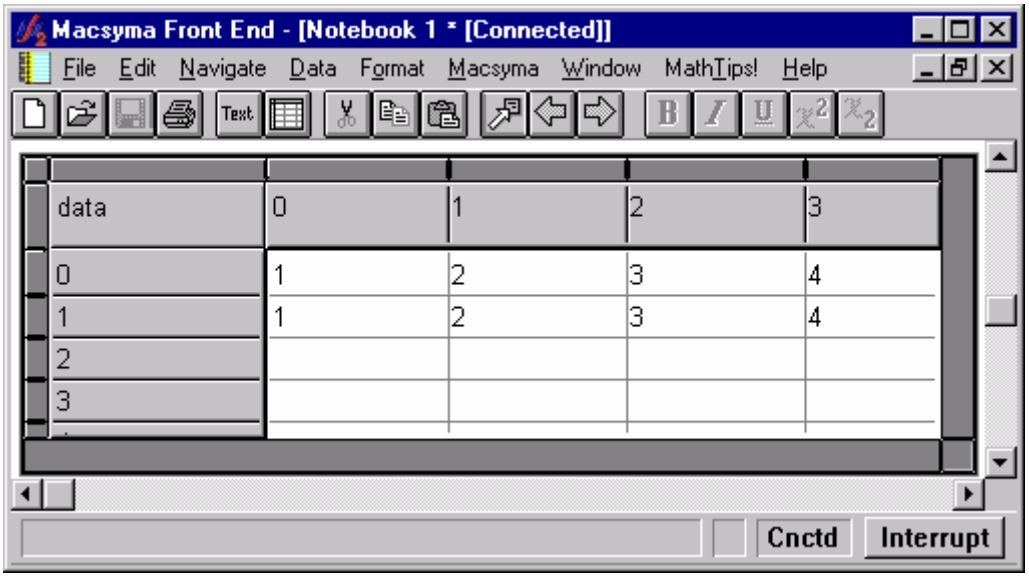


Figure 8 DataViewer

and

1.11,2,3.33,4.44
1.11,2.22,3.33,4.44

will appear as

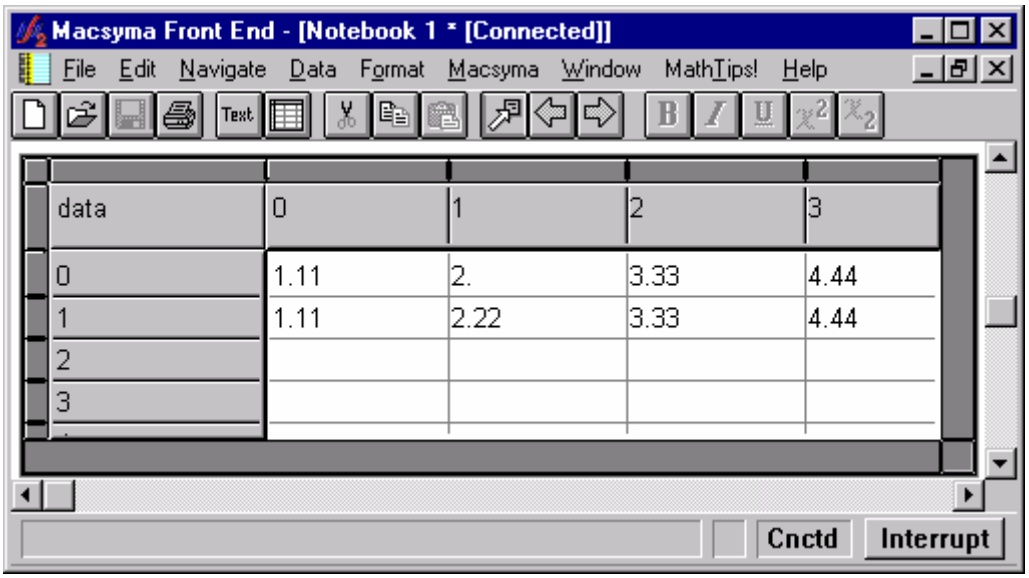


Figure 9 DataViewer

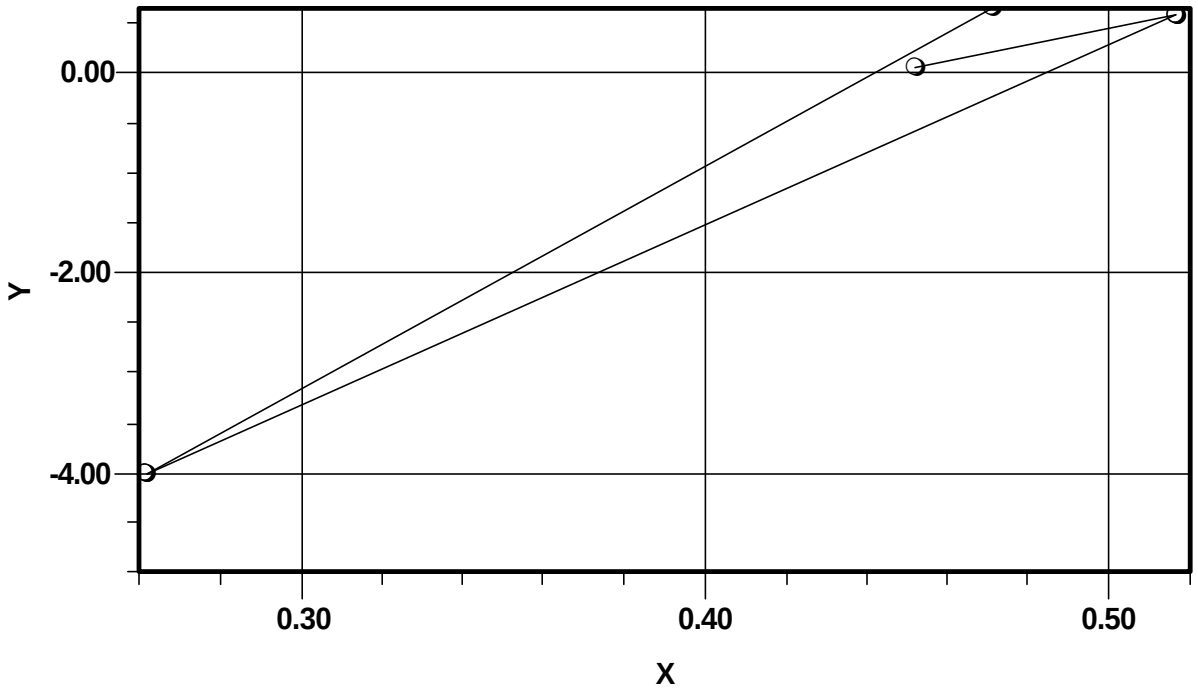


Figure 10 Macsyma graphic

Finally, you can use the MFE variable bar in Macsyma by saying, for example, foo:mfe_get(bar) to create a 4 x 4 matrix foo. Or make a scatter plot of column 0 against column 1 by saying Graph2D_data2D(mfe(bar), 'col, 0, 1,[19]), zero_based_arrays:true; Or make a 3D plot of the data by plot3d_data(mfe(bar)).

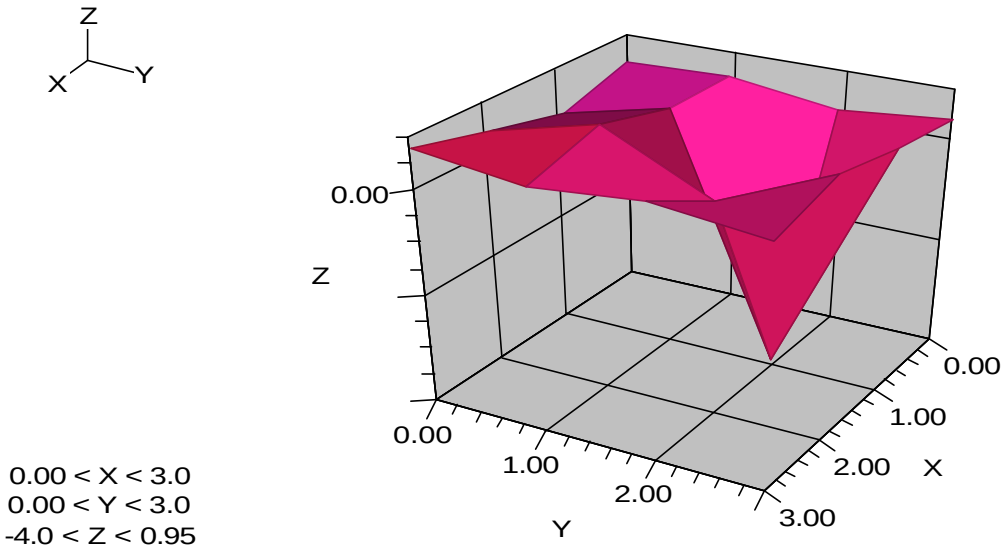


Figure 11 Macsyma 3D graphic

Data Menu Item	Description
View	Displays an MFE math object (one- or two-dimensional array) in a DataViewer section.
Graph	Graphs an MFE math object (one- or two-dimensional array) in a Graphics section. ■ *1D Objects:* The graph will use the math object for the y-axis and the integer index in the DataViewer for the x-axis. ■ *2D Objects:* The graph will use the row-index for the x-axis, the column index for the y-axis, and the values for the z-axis.
Import	Import data from a file to a symbol name in the MFE math engine. You must specify the file pathname, the name of the variable into which the data will be loaded, and the import file format.
Export	Export data to a file from a symbol name in the MFE math engine. You must specify the file pathname, the name of the variable from which the data is taken, and the export file format and its parameters.
Clear Variable	Clear a variable in the MFE math engine. You can select multiple variables to clear at the same time. ***Note:*** The MFE math engine is separate from the Macsyma math engine, and each has an independent set of variables. If you create a new notebook, the MFE variables in an existing notebook are not available to the new notebook, but the Macsyma math engine variables are available.

4.7. Window Menu

The Window menu contains standard Windows features for arranging multiple notebooks within MFE, including Cascade, Tile Horizontal, Tile Vertical, and Arrange Icons. A second group of items lists the names of the open notebooks.

4.8. Input Menu

The Input menu that appears when you select an Input section lets you edit and send a Macsyma command to the Macsyma math engine for processing.

Input Menu Item	Description
Send Command No Print	Executes the command in the current Input section but does not print the result in a new Output section. Press Ctrl+Enter or end the Macsyma command with a dollar sign ($) and press Enter.

Input Menu Item	Description

Send Command	Executes the command in the current Input section and prints the result in a new Output section. Press Enter.
Clear Label	Clears the input line label from the left side of the Input section.

4.9. Output Menu

The Output menu that appears when you select an Output section lets you send a Macsyma command to the Macsyma math engine for processing.

Output Menu Item	Description
Reset Height	Resets the height of the selected section to default values.
Send Command No Print	Executes the command in the current Output section but does not print the result in a new Output section. Press Ctrl+Enter or the dollar sign ($) and press Enter.
Send Command	Executes the command in the current Output section and prints the result in a new Output section. This can be accomplished by pressing Enter.
Clear Label	Clears the input line label from the left side of the Input section.

4.10. Macsyma Menu

Macsyma Menu Item	Description
Batch File	Batches a command file into the Macsyma environment just like the Macsyma batch command. Batch executes a file and displays the input and output expressions, while load executes a file without displaying the input or output.
Connect/Disconnect	Starts a Macsyma math engine and connects it to the currently selected notebook. If a Macsyma math engine is already connected to that notebook, Connect becomes Disconnect, which terminates the Macsyma math engine.
Exit	Terminates MFE and the Macsyma math engine.
Load File	Loads a file into Macsyma. Equivalent to the command load. Note that load file executes a file without displaying the input or output, while batch file executes a file and displays the input and output expressions.
Make Notebook	Converts a text command file into an executable notebook without executing any commands in the notebook. Execute the resulting Input sections by selecting them and clicking *Macsyma-Reexecute*, which is equivalent to the Macsyma command make_notebook.

4.11. MathTips! Menu

Selecting *MathTips!* brings up the Macsyma MathTips with the Natural Language Search Dialog. After entering "polynomial" in the search box, the dialog box looks something like the following

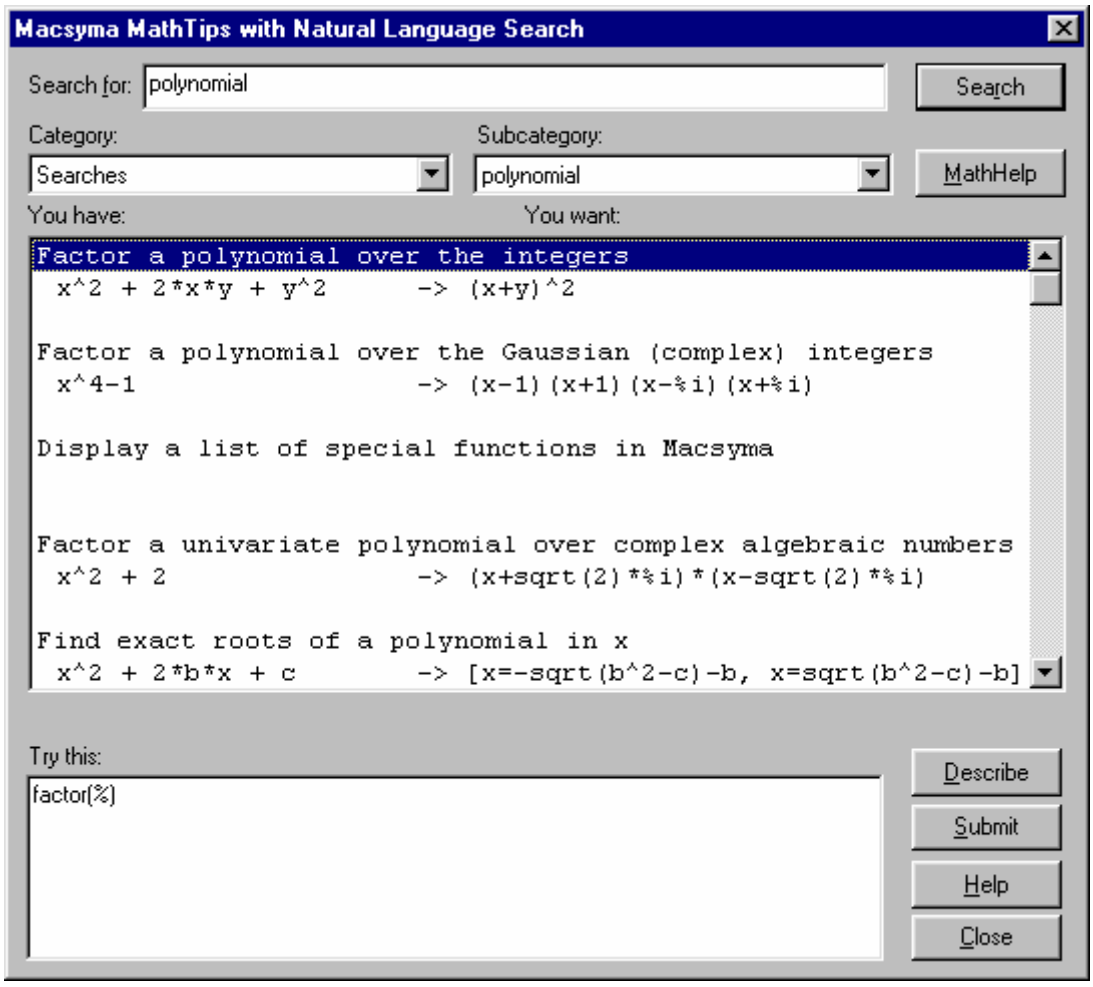


Figure 12 MathTips dialog box

4.12. Batch Menu

MFE supports a batch processing capability for notebooks (**batch.mfe**.) Here's a notebook with three batch sections:

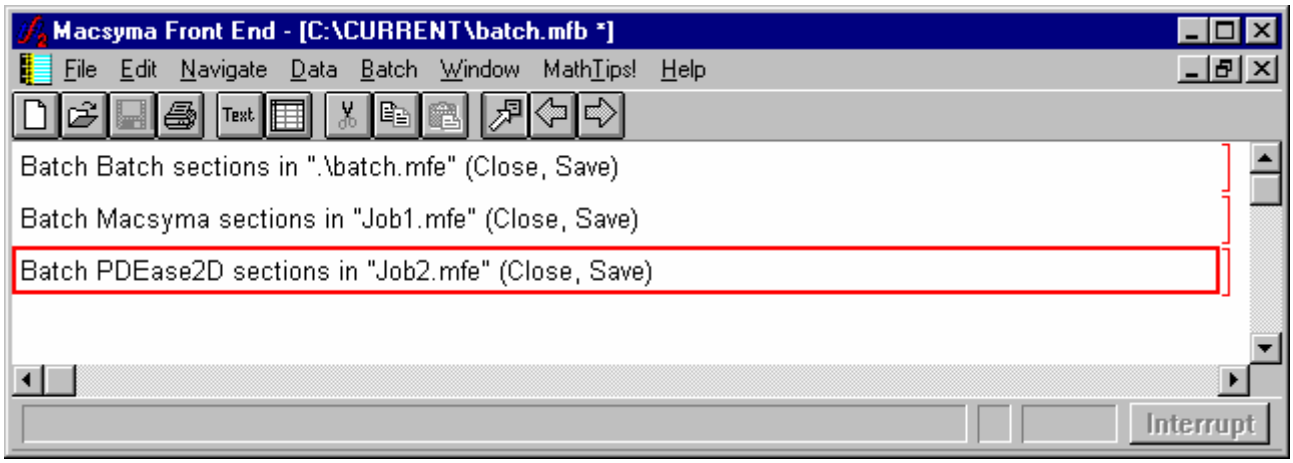


Figure 13 Batch Section

Batch Menu Item	Description
Batch	Starts batch processing of each section in sequence. Batching invokes either the Macsyma or PDEase Math engine, as appropriate. A new engine will start for each section.
Change Parameters	You can change the parameters for each batch section. These include the name of the notebook, whether to leave the notebook open or closed, and whether to save it after batching.
Stop Execution	halts batch processing immediately.

Note:

1. A notebook with batch sections cannot be self-referential, *i.e.* a batch notebook can't batch execute itself. If the notebook *batch.mfe* contains a batch section ("Batch batch sections in .\batch.mfe"), for example, all the other sections for Job1 and Job2 will batch, thereby avoiding the self-reference problem.
2. Batch execution stops whenever an error occurs or the program goes into an "input wait state." Such conditions occur, for example, when Macsyma asks a question like "Is x positive, negative or zero?" or when a computational error occurs.
3. A batch notebook can contain a sequence of Macsyma batch sections. Each Macsyma section executes in spatial order from the beginning of the batch section with a new Macsyma math engine and the engine is disconnected before proceeding to the next batch section. A batch notebook can also contain a sequence of PDEase sections, which are executed in spatial order. A new PDEase

math engine starts for each PDEase section. If the notebook contains both Macsyma sections and PDEase2D sections, the math engines share MFE variables.

4.13. PDEase Menu

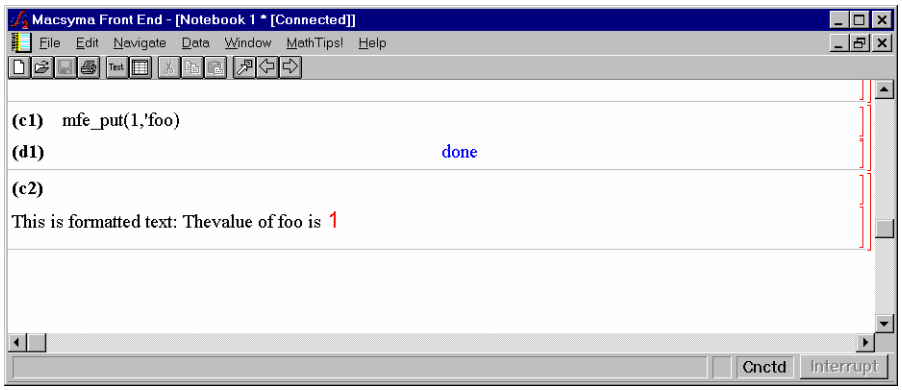
PDEase Menu Item	Description
Execute	Starts the PDEase engine and executes commands in the current PDEase Interaction section.
Erase	Removes all Graphics and DataViewer sections produced by the PDEase engine.
Pause	Pauses the PDEase engine.
Resume	Resumes running the PDEase engine.
Interrupt	Interrupts the currently running PDEase engine
Disconnect	Disconnects the currently connected PDEase engine.
Connect	Connects to a new PDEase engine.

4.14. Format Menu

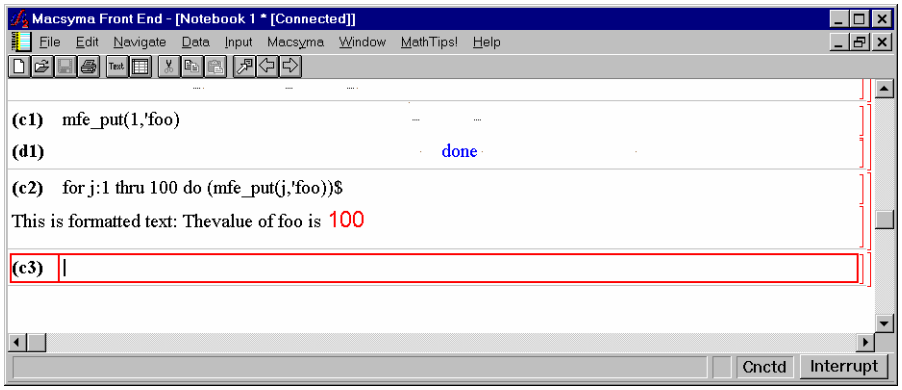
To format items in a Text or PDEase section, you can mark text and use the Format menu to alter character formats and to create and edit hyperlinks. The Format menu appears when you select a Text section.

Format Menu Item	Description
Character	Changes font family, size, and style. (See toolbar buttons.)
Bold	Bolds the currently selected text.
Italic	Italicizes the currently selected text.
Underline	Underlines the currently selected text.

Format Menu Item	Description
Superscript	Elevates and shrinks the currently selected text. Undo superscripting by selecting text and pressing Shift+ the Superscript button.
Subscript	Lowers and shrinks the currently selected text. Undo subscripting by selecting text and pressing Shift+ the Subscript button.
Paragraph	Changes the alignment, left and right indentation, tab size, and vertical spacing of a paragraph.
Remove Character Formatting	Removes the paragraph formatting of the currently selected Text section.
Align	Controls alignment: left, right, center, or none. (Default: None)
Style	Controls choice of paragraph and character styles
Show Codes	Controls display of word-processing codes, such as paragraph marks, spaces, and hypertext links. See *4.18. Formatting Text,* page 45, for an overview of how to edit fonts in a notebook.
Create Link	Creates a hypertext link between the selected text and a chosen notebook section. Displays a dialog with the contents or names of notebook sections to which you can create a link. The dialog can display sections from the current notebook or from all available notebooks. By default, the active text is underlined and green. To make a hypertext jump, double-click on the active text. Alternatively, creates a link to an external notebook with an absolute or relative filename. Can also create a link to a URL. If the link is to a URL, the default browser opens when the link is clicked.
Edit Link	Changes the target of the text link You can edit the contents of the active text without opening the Edit Link Dialog. When defining or editing hypertext links, use the *Choose Section* Dialog to select a link target. For casual use, linking via section contents is fine. However, if you intend to make durable hypertext links, especially across multiple notebooks or for distribution to others, you should name your target sections and link by name. For more information about hypertext in notebooks, see *3.4.3. Notebook Hypertext,* page 17.
Insert Calculated Field	Displays the value of an existing scalar MFE variable in a Text section. The value of the MFE variable dynamically updates in the formatted text section. For example, you can create a notebook that looks like this after executing line (c1) in the following:



The notebook looks like this after executing line (c2):



Here the calculated field in the formatted text section is the value of the MFE variable **foo**, and the field has been formatted in a large red font.

4.15. Graphics Menu

The Graphics menu that appears when you select a Graphics section lets you refine the appearance of graphics in notebooks.

Graphics Menu Item	Description
Camera View	Changes the camera position by rotating, rolling, and trucking the camera (see *6.4. Camera View Dialog*, page 59). You can also zoom and clip the plot with a plane in front of the camera. See also *6.3. Graphics Attribute Editor Dialog*, page 58.
Bounding Box & Axes	Opens the Bounding Box Attributes Dialog (page 62), in which you can edit various attributes of the bounding box and axes.
Surfaces	Opens the Surface, Line, and Point Attributes Dialog (page 61), in which you can edit the attributes of the plotted surfaces, lines, and points.

Graphics Menu Item	Description
Decorations	Opens the *Graphic Decorations Editor Dialog* (page 63) so you can set the plot title and other text annotations. (Shortcut: toolbar button.) Attributes Opens the *Graphics Attribute Editor Dialog* (page 58), which contains controls for setting many attributes. A typical three-dimensional plot has over 150 modifiable attributes.
Styles	Opens the Graphics Styles menu.
Animation	Opens the Animation Dialog (page 63) so you can set animation controls, including recording bitmaps and playing animation sequences.
Play Animation	Plays an animation. (Shortcut: toolbar button.)
Perspective	Toggles perspectives in 3D plots on and off. (Shortcut: toolbar button.) See the View: Perspective attribute in *7.4.1. Camera View Attributes,* page 74.
Normalized (World Scaling)	Forces all axes to have the same length scale, so an ellipsoid looks like an ellipsoid. When this flag is unchecked, an ellipsoid looks like a sphere. (Shortcut: toolbar button) See the Scale attribute in *7.4.1. Camera View Attributes,* page 74.
Fit to Pane (Window Setting)	Stretches a graphic horizontally and vertically to fit the windowpane. (Shortcut: toolbar button.) See the Scale: Window attribute in *7.4.1. Camera View Attributes,* page 74.
Export	Opens the *Export* Dialog, so you can specify the graphic filename and type. The supported file types are .BMP, .GIF, .PCX, and .RLE. (Shortcut: toolbar button.). ■ ***BMP:*** The Windows native uncompressed format for bitmap files. Virtually all Windows applications that can import or read graphic files will accept this format. The drawback is that, being uncompressed, these files can be large if the graphic is exported at the default 300 pixels per inch resolution. The BMP file type supports 2, 16, 256, and 16 million color subformats. ***Note:*** You can use the Export/Bitmaps: Pixels per Inch entry in the *Graphic Attributes* Dialog to change the resolution. ■ ***RLE:*** The Windows native compressed format for bitmap files. Most mainstream Windows applications can read RLE files. For typical Macsyma-generated graphics, the compression provided by this format can be substantial. The RLE file type supports only 16 and 256 color subformats. ■ ***PCX:*** Another widely used compressed bitmap format which most mainstream Windows applications accept. Many Macintosh programs can also interpret this format. The file type PCX supports 2, 16, 256, and 16 million color subformats.

Graphics Menu Item	Description
	■ ***GIF:*** An LZ compressed format that will generally achieve somewhat better compression than RLE or PCX. GIF is widely used on CompuServe and other BBS and can be imported by many applications, both under Windows and on other platforms. GIF does not offer a 16 million-color subformat but can produce 2, 16, and 256 colors.
Add Data to Graph	Adds the graph of an MFE variable to the currently selected graph. Since MFE variables have values with implicitly assigned integer coordinates, plots work best when you add the graph of an MFE variable to the graph of another MFE variable rather than to a plot created by the Macsyma math engine.
Assign Data to Variable	Opens a dialog in which you can specify the name of a variable in the MFE math engine that stores the plot-point data from the currently selected graphic. You can perform the inverse operation — plotting the data in an MFE array — using the Data-Graph.**{**xe "Assign Data to Variable, Graphics menu"**}{**xe "Graphics menu: Assign Data to Variable"**}** Assign Data to Variable may now create more than one new variable per presenter. Also, a separate MFE variable is now automatically created for each multiple presenter graphic. For the following, assume you type the variable name SomePlot in the Assign Data to Variable dialog. A graphic with a single 2D presenter, DPr2D_0 will create two MFE variables: SomePlot — Base variable containing graph data SomePlot_DPR2D_0_Xindex — Array of index values (values of the independent variable). A graphic with a single 3D presenter, DPr3D_0 will create three MFE variables: SomePlot — Base variable containing graph data SomePlot_DPR3D_0_Xindex — Array of index values (values of the first independent variable). SomePlot_DPR3D_0_Yindex — Array of index values (values of the second independent variable). A graphic with *k* ?D presenters, DPr?D_x will create *k* MFE variables: SomePlot_DPr?D_*I* — *k* base variables containing graph data, one for each presenter SomePlot_DPR?D_i_Xindex — Arrays of index values (values of the first independent variable) for each presenter SomePlot_DPR?D_i_Yindex — For any 3D presenters, arrays of index values (values of the

second independent variable).

4.16. DataViewer Menu

The DataViewer menu contains items for performing operations in a DataViewer section.

DataViewer Menu Item	Description
Graph	Creates a graph of the data that is displayed in the DataViewer section.
Go To	Jumps to row and column specifications (cells) in the DataViewer section.

4.17. Help Menu

The Help menu accesses the online help system. You can access context-sensitive help by clicking on a Macsyma command or topic name and pressing F1.

Note: For more information about online help, see *Chapter 5. Using Online Help,* page 49.

Help Menu Item	Description
Math Tips	Opens the MathTips advisor, which suggests command(s) for performing many common computational tasks. See *5.6.1. MathTips™ Advisor,* page 50.
Front End Browser	Engine-specific browser. Changes to Macsyma or PDEase.
Front End Contents	Indexes help topics for Macsyma and PDEase math engines. Context specific.
PDEase2D Browser	Opens the PDEase Topic Browser
PDEase2D Contents	Provides an index of help topics for the PDEase math engine.
PDEase2D Search	Provides a searchable database for PDEase math engine help.
PDEase2D Samples Search	Provides a natural language search through the PDEase sample notebooks.
Help on	Provides context-sensitive help. If you place the pointer on a Macsyma command or topic name (for example, on the **ratsimp** command), the first item on the Help Menu is Help on **ratsimp**. You can use F1 for context sensitive help as well.
Macsyma Demos	Lists all executable demonstrations in Macsyma, organized by mathematical topic, and then alphabetically by the name of the demonstration. You can execute a demonstration by clicking on its name. Executable examples of individual commands are not included in this list.
Macsyma	Displays Macsyma-specific help items.
PDEase2D	Displays PDEase-specific help items.
Index	Indexes alphabetically all help topics in the main Macsyma hypertext description system.
Help on Help	Introduces you to the Windows help systems.

Help Menu Item	Description
About	Contains version information about MFE.Help Menu Item Description
Check Web Site	Connects your browser to the Macsyma Web site http://www.macsyma.com for late breaking news, information and patches affecting your Macsyma or PDEase.

4.18. Formatting Text, Fonts and Styles

4.18.1. Font Controls

You can change fonts in the following notebook sections:

- Input
- Text
- DataViewer
- Output
- Graphics
- PDEase

You can select fonts by changing attributes in the *File-Options* and *File-Options Default* Dialogs. When you open these dialogs, you see windows that look like the following for the Notebook, Math and DataViewer categories, respectively:

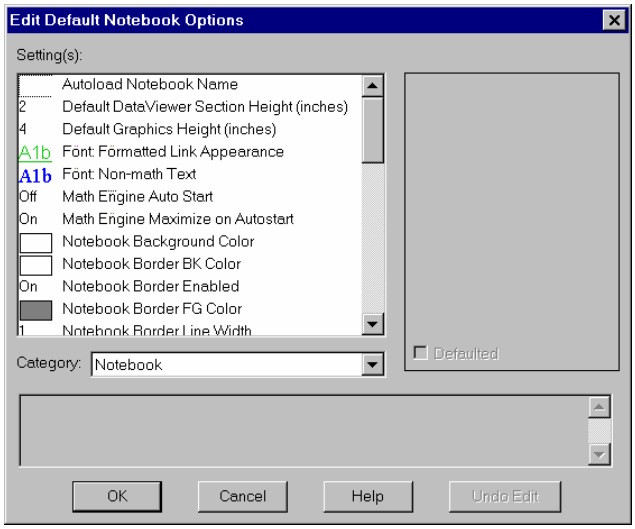


Figure 14 File-Options Default Dialog

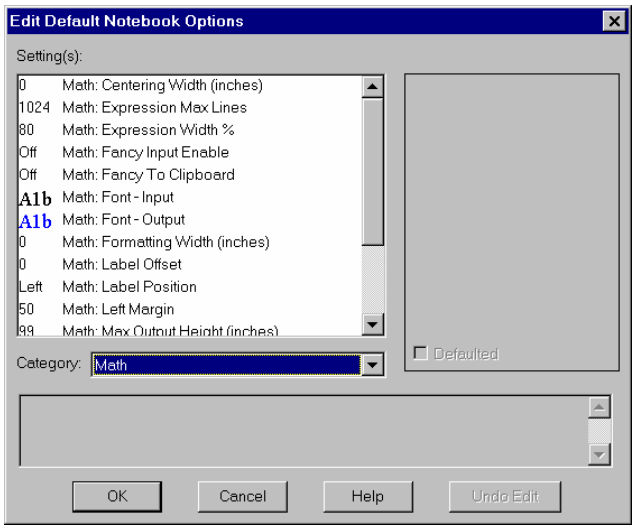


Figure 15 File-Options Default Dialog

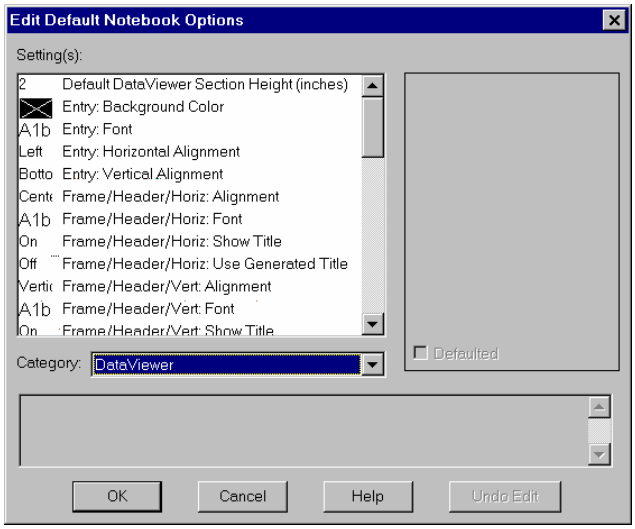


Figure 16 File-Options Default Dialog

4.18.2. Text Styles, Style Sheets and Templates

In addition to changing the individual attributes of characters and styles in Text sections, you can use an MFE text style. A *text style* is a named collection of character and paragraph attributes that can be applied as a group to a paragraph or to a selected sequence of characters. A *style sheet* contains a set of text styles designed for general use. A *template* contains a collection of styles along with standard content. Typically, you use a template only to create a new notebook. A *style sheet* may be applied at any time.

You can use a predefined template for a new notebook by clicking on *File-New*. MFE will let you choose a template from the MFE\Templates directory or select any other MFE notebook you want to use as a template.

When you open a notebook as a template, the new notebook is unnamed so that you don't accidentally overwrite your template. Also, the style sheet specified in the template or by the default attribute settings is automatically reapplied.

Pre-defined styles are located in the notebook NORMAL.MFE in the MFE\Styles directory. Normal is also the default value of the Style Sheet attribute. You may change Style Sheet attributes in *File-Options*. Changing this attribute in *File-Options Default* affects all notebooks that don't specify a style sheet.

Changing the Style Sheet attribute has no immediate effect. You must click on *File-Reapply Style Sheet* to load the latest set of styles from a shared style sheet. You can overwrite styles you have previously applied by using the same style name but changing the attributes and reapplying the style sheet.

To access the text styles system:

1. Select a Text section in a notebook.
2. Click *Format-Style* to open the *Styles Dialog*.

The *Styles Dialog* contains:

- A listbox for selecting styles.
- Buttons for adding new styles and deleting existing styles.
- Buttons for altering the font or paragraph attributes associated with a style.
- Buttons for applying the selected style to a paragraph or a selected region of text.

After loading a template or a notebook, click *Format-Style* to see the available styles in the Styles listbox. The Styles listbox for a PDEase template looks something like:

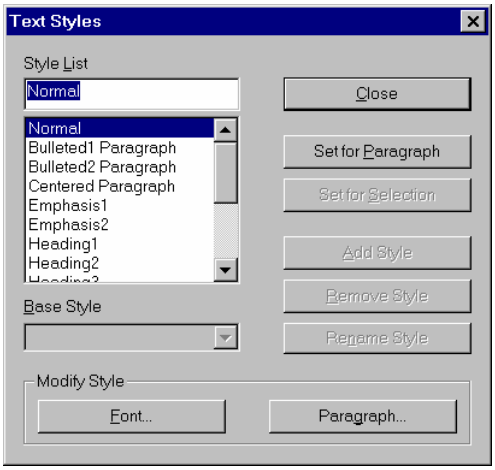


Figure 17 Text Styles Dialog

You can select font face, color and emphasis, as well as paragraph and word alignment with styles, style sheets or templates.

Chapter 5.
Using Online Help

5.1. In This Chapter

5.2. The Help Menu

Help menu contents change dynamically, according to the active math engine. Each math engine's online help includes:

- A Topics Browser
- A searchable index of help topics
- A searchable index of contents

5.3. Help Browsers

The Help Browser lets you search by: :

- Category
- Subcategory
- Topic

After selecting a topic, click *Describe* to learn more about it.

5.4. Windows Help Enhancements

You can execute Macsyma demos and examples and PDEase sample problems via hot links.

5.5. Context-Sensitive Help

MFE looks for a help topic based on the cursor position. Press F1 or click *Help-Help On* to access context-sensitive help for this topic.

5.6. Macsyma Help Features

Macsyma help features include:

5.6.1. MathTips™ Advisor

The MathTips™ advisor provides sample problems and solutions for many common computational tasks. You can open the MathTips advisor from the Help menu.

After selecting a particular task from the MathTips advisor, click Submit. If you select an Output section when you enter MathTips, you can often apply the suggested code to the selected output.

The MathHelp button opens the MathHelp Browser (See page 50).

5.6.1.1. Using Tips via Natural Language Query

You can access the MathTips advisor using a "natural language query." For example, to get tips on finding roots of polynomials you can query with "find roots of polynomials" to get something that looks like:

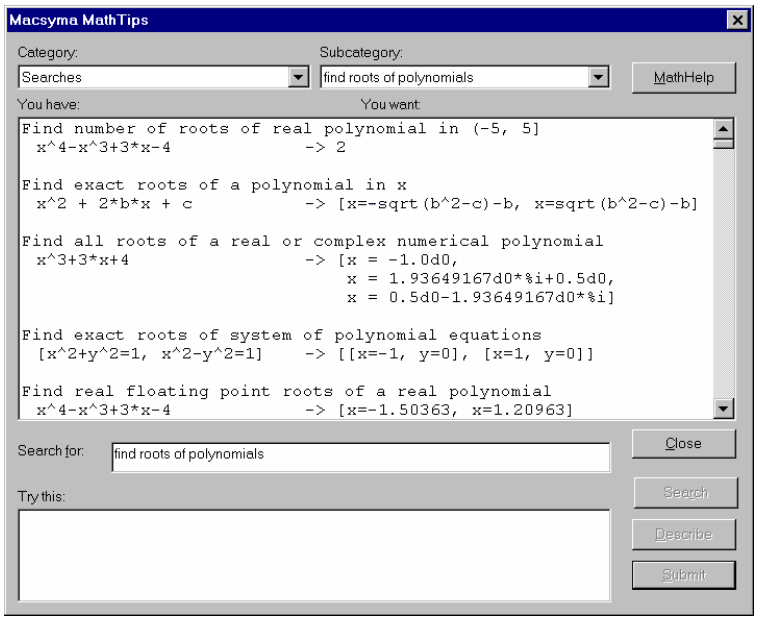


Figure 18 MathTips Dialog w/Natural Language Query

Or you can query with "Please help me find roots of equations so I can get a good grade."

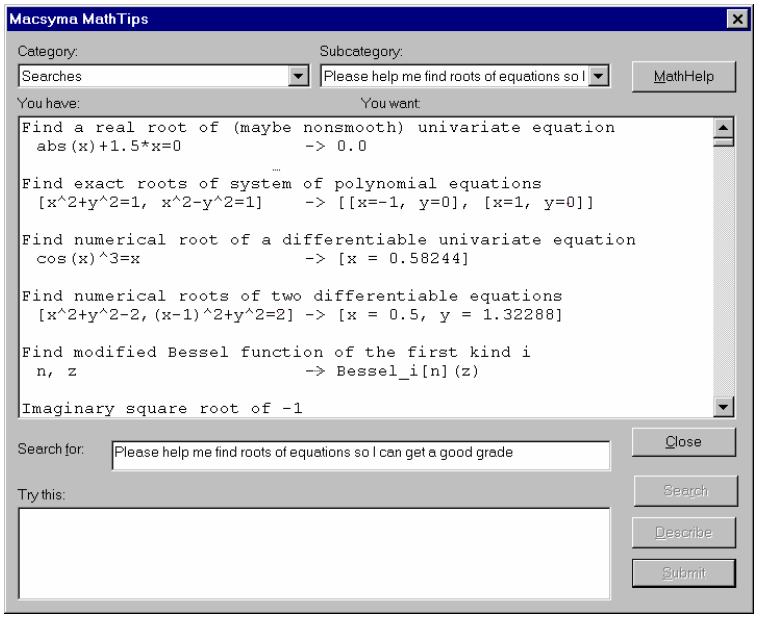


Figure 19 MathTips Dialog

5.6.1.2. Using Tips via Browsing

Access the MathTips Dialog from the MathHelp Browser by clicking the *Tips* button.

5.6.2. Macsyma MathHelp Browser

You can open the MathHelp Browser from the MFE toolbar.

MathHelp browser buttons include `Describe,` `Example,` and `Template,` and Packages, which provides a list of the library packages. When you select Packages, the buttons offer a different set of help choices, including usage (a more in-depth description), and a button to launch an executable demonstration.

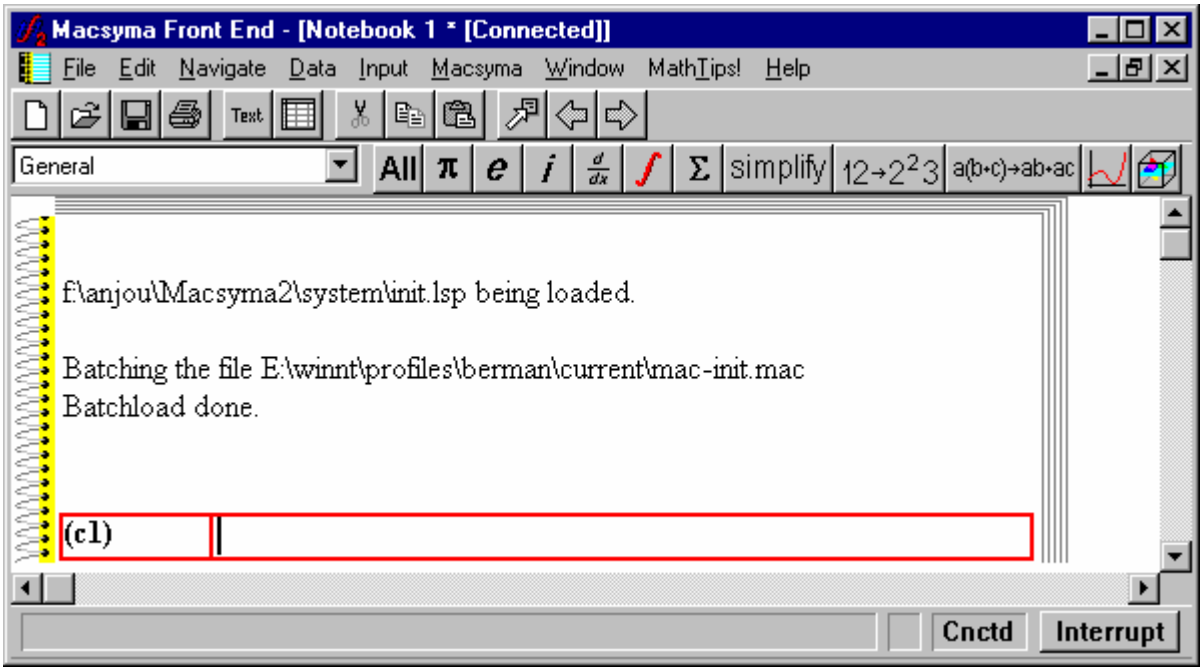
You can jump from MathHelp to the MathTips Advisor by clicking the *Tips* button.

5.6.3. Function Templates

The MathHelp Dialog specifies the arguments to a Macsyma command, identifies optional arguments, and provides blank spaces for you to compose your own command. You can access a Function template for nearly any command in the MathHelp topic browser by selecting that command and pressing the Template button.

- Clicking *MathHelp*, a topic, a subtopic, a command, then clicking *Describe*.
- Type the Describe command in a selected Input section.
- Clicking *Help-Front End*, and the MFE Help window appears.

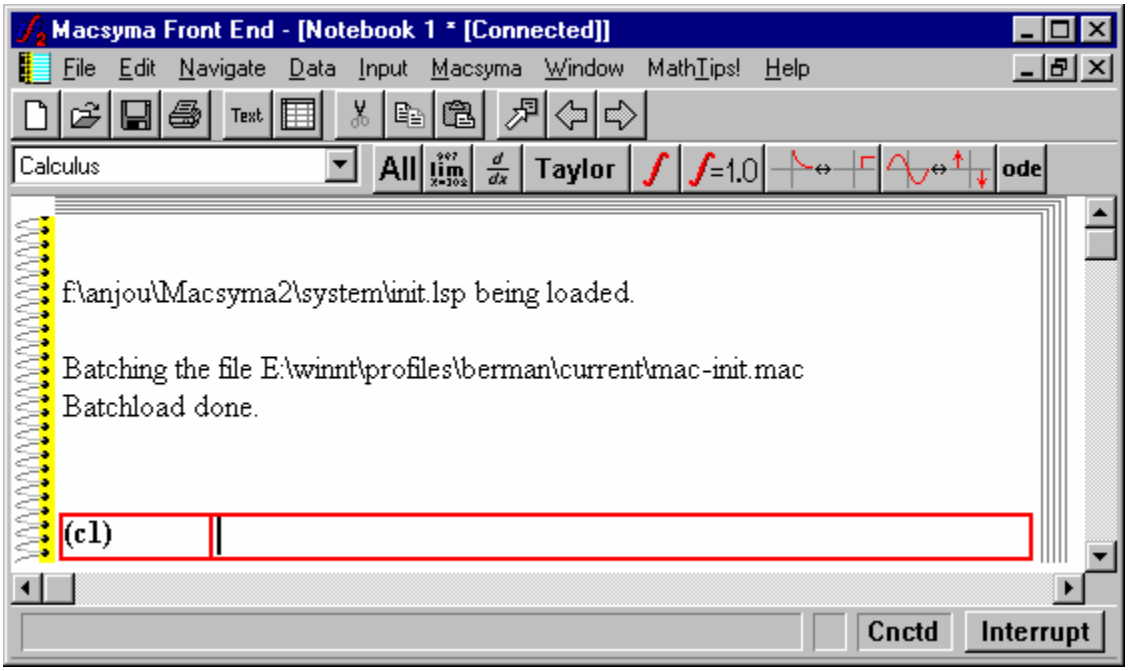
Many of the Macsyma Button Bars bring up Templates as well. The buttons are available in Macsyma notebooks.



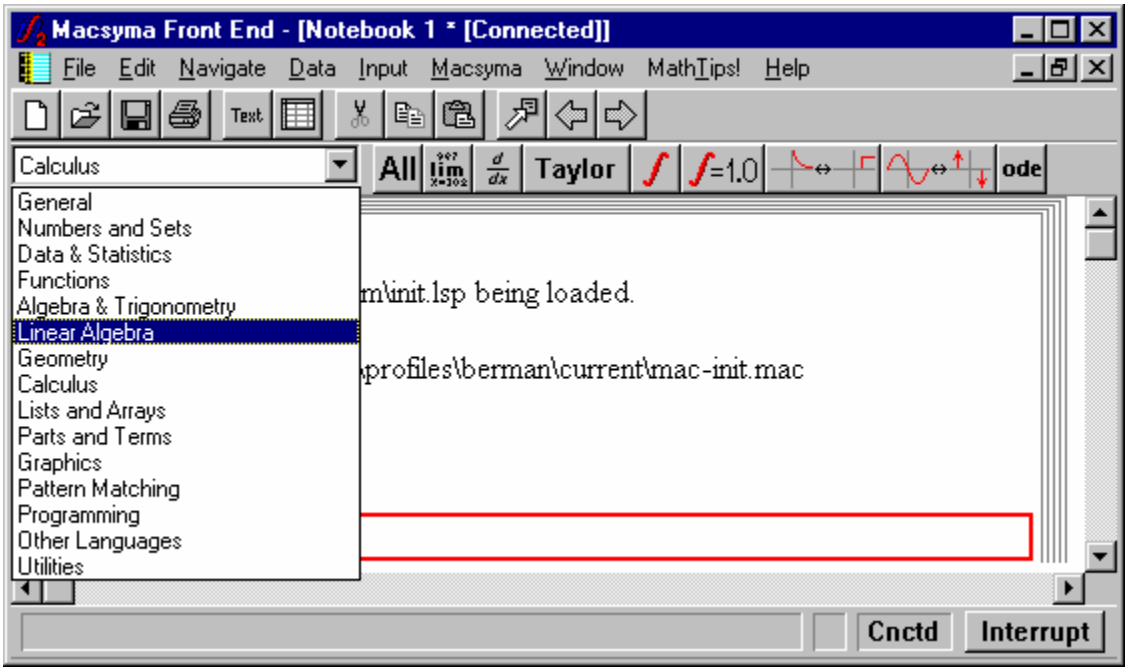
shows the general button category: You can choose to enter constants %PI, %E or %I, or bring up a DIFF

template, an integrate template, a sum template, you can simplify, factor or expand; or you can draw 2D or 3D graphics.

For example, in the Calculus category, you have buttons for limits, differentiating, Taylor series, symbolic or numeric integration, Laplace or Fourier transforms, or solving ODEs.



The entire group of button-template categories includes



5.7. PDEase Help Features

5.7.1. PDEase Topic Browser

You can obtain a hierarchy of topics about PDEase by clicking Help-PDEase-PDEase Browser. The topic browser looks something like:

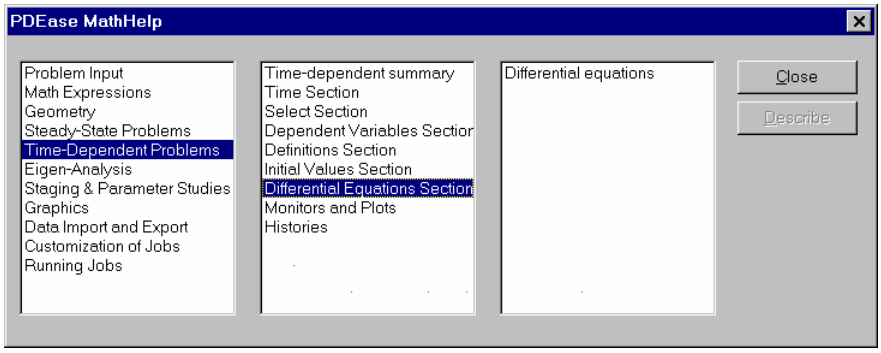


Figure 20 PDEase MathHelp

5.7.2. PDEase Contents

The table of contents for PDEase on-line help lists over 300 topics that you can access the descriptions through the topic browser or type the topic name into the search dialog. PDEase2D Help Contents looks something like:

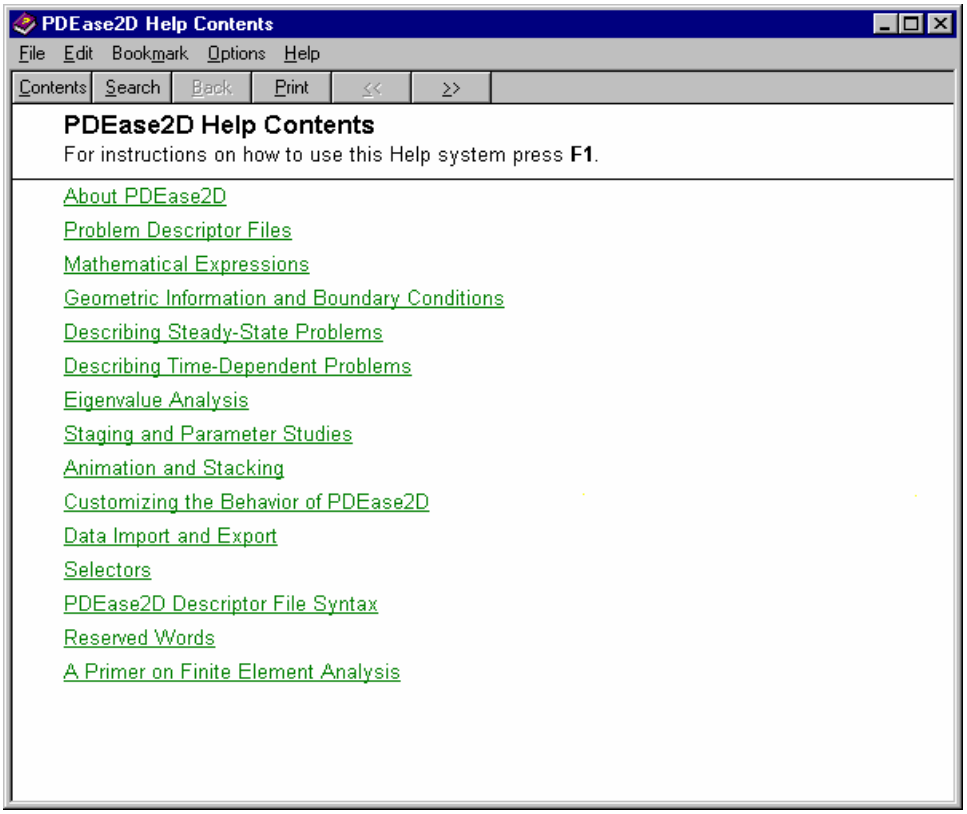


Figure 21 PDEase2D Help Contents

5.7.3. PDEase Search

You can also search the PDEase database with a search engine. It looks something like:

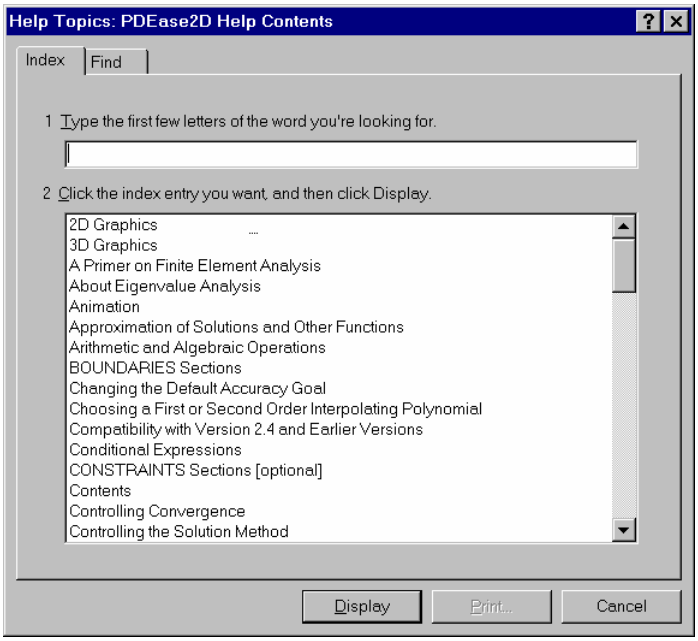


Figure 22 PDEase2D Search

5.7.4. Samples Search

The PDEase Samples directory includes over 140 sample files. You can search through the sample topics to find a problem similar to yours.

The sample search looks like:

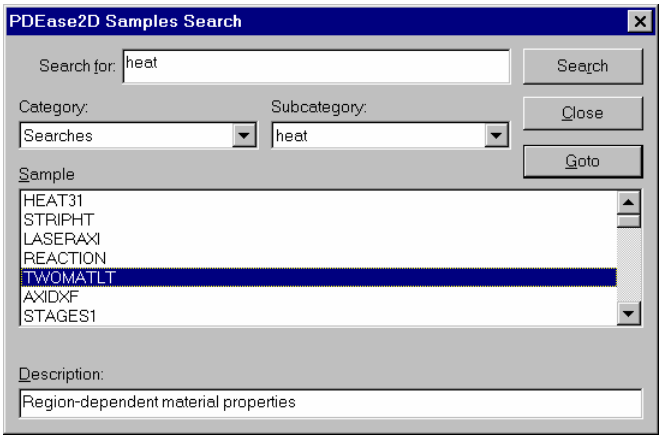


Figure 23 PDEase2D Samples Search

Chapter 6. Using Dialogs

6.1. In This Chapter:

6.2. Choose Section Dialog

Use the *Choose Section* dialog to select a section (by contents or by name) in a loaded notebook. You can also use this dialog to browse the file system and load notebooks.

To open *Choose Section*, use *Navigate-Goto* or the Navigate button. For example, after loading the notebook macsyma:demo;orthcor3.mfe, you can click *Navigate-Goto* and see something like:

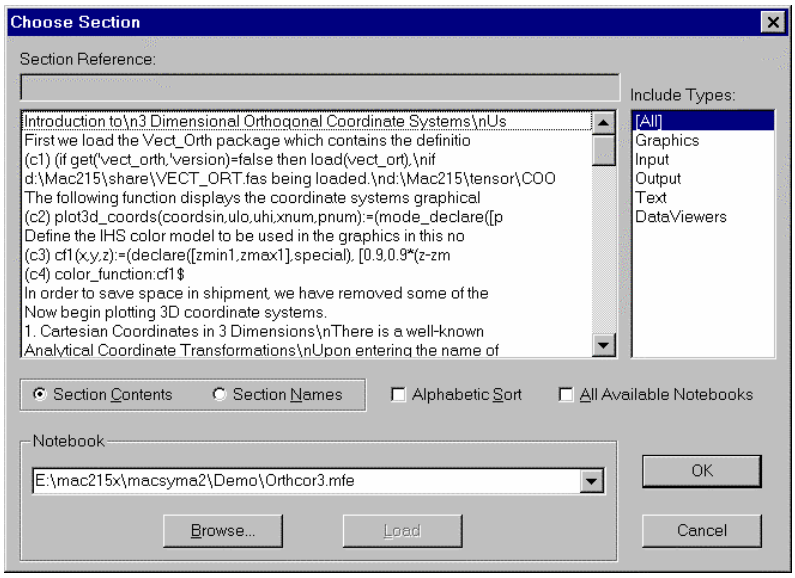


Figure 24 Navigation Dialog

You can choose to view the first 64 characters of each section or the names of all named sections. You can choose to view all sections or only Graphics, Input, Output, Text, or DataViewer sections.

6.3. Graphics Attribute Editor Dialog

The *Graphics Attribute Editor* dialog gives you access to every settable graphics attribute in the MFE graphics subsystem. However, it can be more useful to use other graphics dialogs for graphic editing.

To open the *Graphics* Attribute Dialog, select a Graphics section in a notebook and click *Graphics-Attributes*. The toolbar button which looks like a selector dial pointing to letters of the alphabet, opens this dialog, which looks something like:

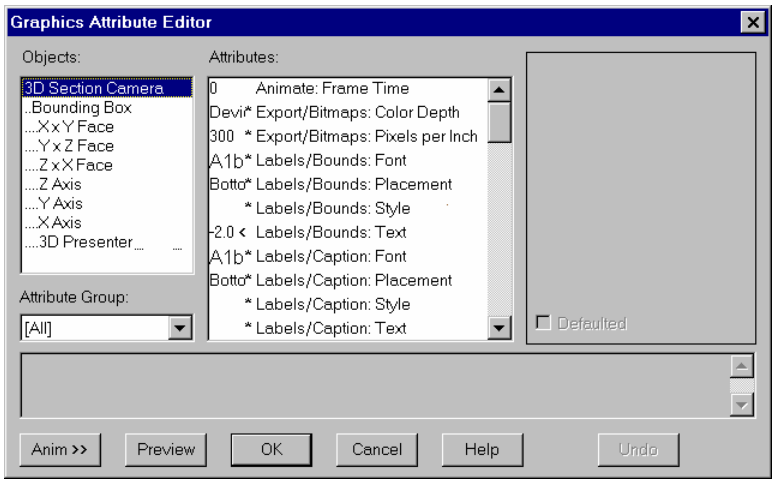


Figure 25

6.3.1. Objects Listbox

The Objects listbox displays a graphic's object hierarchy. Select any object to see a list of its attributes. Two and three-dimensional graphics have different hierarchies. Section Camera attributes control many top level features, such as camera and view center positions, perspective, lighting, graphic title and caption, camera clipping and scaling, and other general rendering settings.

You can specifically override face-related settings at the Bounding Box level.

- Bounding Box: Attributes control display of grids, ticks, axis labels and titles, box face colors.
- X x Y Face
- Z x Y Face (3D only)
- X x Z Face (3D only)

You can specifically override axis-related settings at the Bounding Box level.

- Z Axis (3D only)
- Y Axis
- X Axis

You can specifically override attributes that control properties of lines and surface elements used to display the actual data. These include colors, line styles and thickness, point symbols, data cursors, etc., set at the Bounding Box level.

- 2D Presenter (2D only)
- 3D Presenter (3D only)

6.3.2. Attributes Listbox

The Objects listbox shows the attributes of a selected object. Select an attribute and use the right panel dialogue to modify it and re-set to the default value. Default values are inherited from higher levels in the hierarchy.

- Option Defaults
- Notebook Settings
- Section Camera

View your changes at any time by clicking *Preview*. Clicking *Undo-Edit* lets you undo your last edit.

6.4. Camera View Dialog

The Camera View dialog lets you modify your view of a graphic by adjusting the camera and center positions. You can also use this dialog to set a camera clipping plane, truck, zoom, (or employ other viewing options. You can open this dialog from the Graphics menu or the toolbar button. You can also modify view settings through the Graphics Attribute Editor Dialog.

Here are sample Camera View Dialogs for 2D and 3D graphics, respectively:

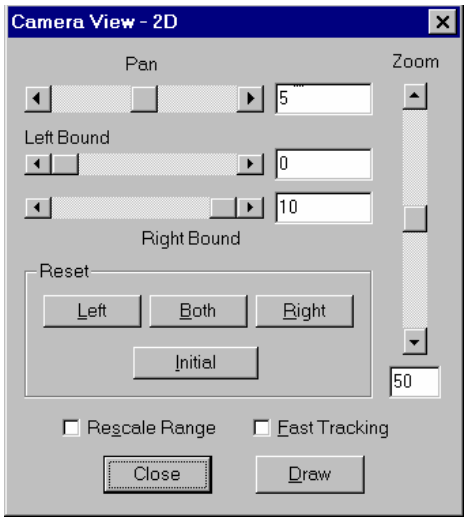


Figure 26 2D Camera View Dialog

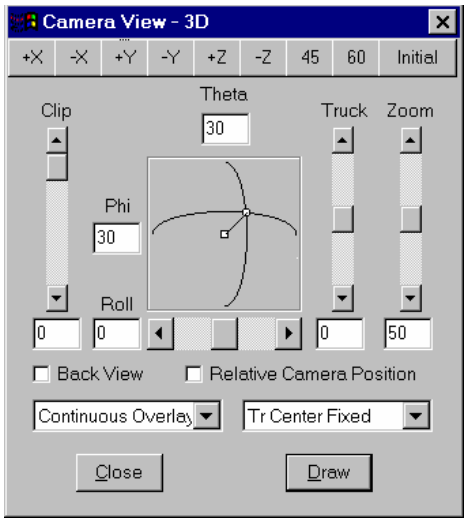


Figure 27 3D Camera View Dialog

Camera View Setting	Description
Camera Position Icon	Repositions the camera viewpoint. The camera is depicted as a small circular shape mounted on a gimbal of two semicircles, which surround the object being viewed. Selecting a Graphics section and pressing Shift+ Left Click moves the center of view to the cursor location, which is useful for changing the center of rotation and zoom.

Camera View Setting	Description
Clipping Slider	Slides a clipping plane out from the camera and through the object you are viewing, letting you easily cut into the object and see interior points.
Truck Slider	Moves you toward or away from the view center. Use the combo box below the slider to choose: ■ *Truck Center Fixed:* The slider "trucks" you toward/away from the center point without moving the center. ***Note:*** Perspective effects can become exaggerated as you near the center. ■ *Truck Moves Center:* The center moves with the camera along the line between the two, allowing you to "walk through" objects without much perspective distortion. ***Note:*** If you rotate with the joystick after moving the center point, that center point becomes the new rotation center.
Zoom Slider	Enlarges or reduces the image without affecting center point or camera position. Use the buttons along the top to snap to a set of canonical views or to your *initial* view. Shift+ Left Click moves the center of view to the current pointer location. ***Note:*** *Initial* refers to the view that was in effect when you opened the View Control Dialog, *not* the initial setting in effect when you generated the graphic or read in a file.
Redisplay Setting	Sets the redisplay setting. Use the combo box on the lower left to select: ■ *Continuous Overlay:* Continuously draws an outline of the bounding box and clipping plane as you move the various controls (the default). ■ *Manual Draw:* Redraws only when the Draw button is clicked. ■ *Draw After Change:* Redraws when you stop moving a slider or joystick control. ■ *Continuous Outline:* Continuously draws an outline (like Continuous Overlay) but shows only the outline while controls are changing. Redraws the full graphic when you stop. ■ *Continuous Draw:* Redraws continuously as controls are moved. You can control camera position and orientation and get excellent dynamic feedback with the joystick control and the roll slider.
Style: Display Style	Displays current graphic style. Use the Styles dialog to change any attributes. Changing this attribute on the camera does not apply the style.

6.5. Surface, Line, and Point Attributes Dialog

The Surface, Line, and Point Attributes Dialog lets you edit the attributes of the plotted surfaces, lines and points, such as color model and constant color settings, and the color and thickness of the wireframe mesh. You can open this dialog from the Graphics menu or with the toolbar button. This dialog looks like:

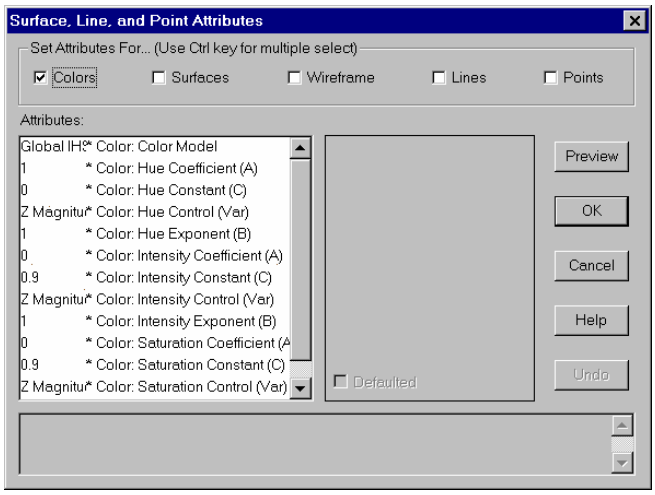


Figure 28 Surface, Lines & Points Dialog

6.6. Graphics Bounding Box & Axes Dialog

The Graphics Bounding Box & Axes dialog lets you edit various attributes of the bounding box and axes, such as axis titles, axis thickness, tick mark spacing, grid line spacing and grid line thickness. You can open this dialog from the Graphics menu or with the toolbar button. This dialog looks like:

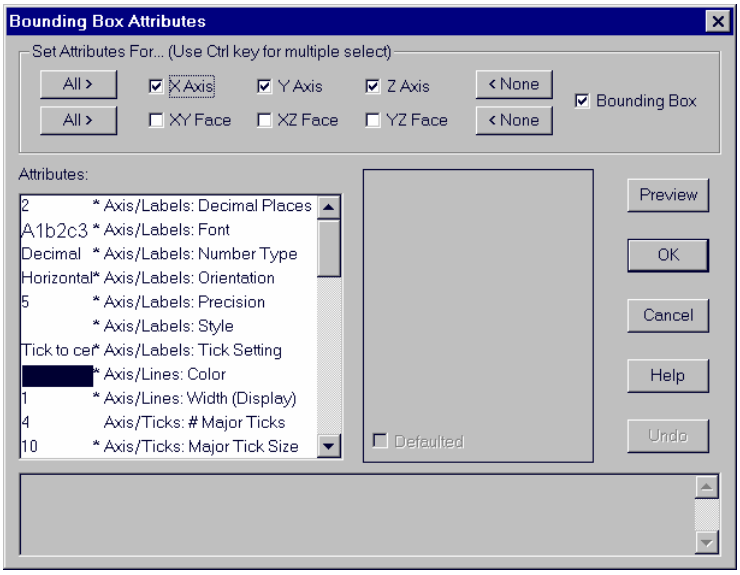


Figure 29 Bounding Box Dialog

6.7. Graphics Decorations Editor Dialog

The Graphics Decorations Editor Dialog contains custom controls for editing all text labels in the plot, except for axis titles, which are controlled in the Bounding Box & Axes Dialog. You can open this dialog from the Graphics menu or with the toolbar button. This dialog looks like:

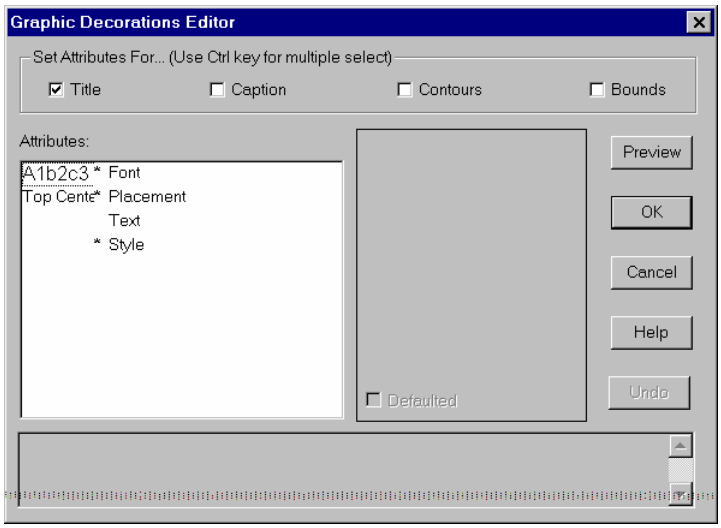


Figure 30 Graphics Decoration

The four text decorations are:

- Title (default position top-center) The Macsyma math engine sets the title when the plot is drawn as the value of the Macsyma title option variable.
- Caption (default position bottom-center)
- Contour Labels (default position bottom-left)
- Bound (default position bottom-left) The Macsyma math engine sets bounds unless the Macsyma plotbounds option variable is False.

6.8. Animate Dialog

The Animate Dialog offers VCR-like controls for playing MFE graphic animations. You can also use this dialog to adjust the total playing time and/or total number of animation frames.

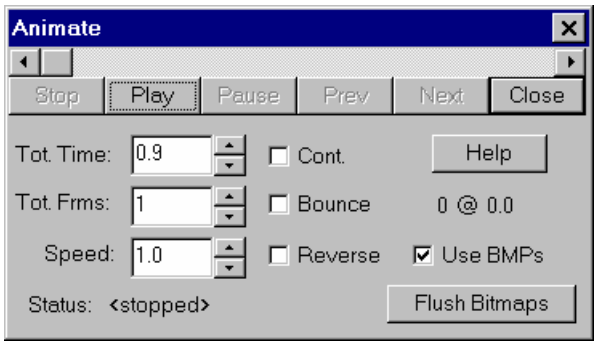


Figure 31 Animate Dialog

When you have disabled an attribute or feature (by choosing a different attribute, for example), the disabled item is grayed. For instance, the Next and Prev buttons are grayed when an animation is playing.

Animation Setting	Description
Stop	Stops the current animation and resets it to frame 0.
Play	Starts playing the animation from the current frame.
Pause	Pauses an animation that is playing.
Prev	Moves a stopped or paused animation back one frame.
Next	Moves a stopped or paused animation forward one frame.
Done	Closes the dialog.
Total Time Thumbwheel	Changes the total duration of an animation. Depending on the speed of your hardware, the size of the animation sequence, and the setting on the Speed Thumbwheel, the time set may or may not be "real" time. Remember, however, that animation transitions are scheduled in total time intervals. If you reduce total time after setting up an animation, you may abridge or eliminate transitions.
Total Frames Thumbwheel	Changes the number of frames in your animation sequence. Changing this value will erase any bitmaps you have built.
Speed Thumbwheel	Runs the animation in exactly the time specified in the Total Time Thumbwheel when set to 1.0. Dial the thumbwheel to slow down or speed up.
Checkboxes	Sets the following: ■ *Cont:* Plays the animation in a continuous loop. ■ *Rev:* Plays the animation backwards. ■ *Bounce:* Plays from start to end, then reverses back to start. ■ *Use Bitmaps:* If this box is checked, the animation displays a compiled sequence of bitmaps (See the Build Bitmaps button). Otherwise, each frame is rendered on-the-fly from the underlying graphic data.
Build Bitmaps	Construct a bitmap sequence for the animation. While the sequence is being generated, this button changes to Cancel Build. Click if you want to terminate the compilation. When the sequence is complete, this button title changes to Erase

Bitmaps, so you can also use it to delete the bitmap sequence.

Note: Use bitmaps, which draw quickly, to play animations at a reasonable frame rate. However, a long animation sequence on a large graphic can require a lot of memory.

Animation Setting	Description
Play Animation	Starts an animation running in a continuous loop in the currently selected Graphics section. While an animation is running, the button changes to Stop Animation. Click the Animation button to access editing features. Click again to return to the "static" configuration. Animatable attributes include all Integer, Float, Color, Vertex, and Box valued attributes. Animations are a set of transitions on one or more animatable attributes. All animatable attributes support the following three transition functions: ■ *Constant Transitions:* Consist of a start value and duration. Constant transitions can be sequenced to create step-function-like variations in an attribute. ■ *Linear Transitions:* Have both start and end values. They transition linearly between start and end values over their duration. ■ *Smooth Transitions:* Start out slowly, reach a maximum rate at the midpoint, and then slow down again as they reach the endpoint. To animate an attribute, select it, choose a transition, and add it to the attribute's transition list. Now select it, and set its duration with the thumbwheel. Add additional transitions to the list as desired. The Transitions list tracks the time each transition will take. When you first add or insert a transition, its start and end values are based on the start and end values of its temporal "neighbors." You can change these settings by entering new values in the Animation Transition Values section. The Camera Settings group sets the total time and frame count for the animation. The time you set in Current Time determines what stage of the animation you see if you press the Preview key. Make sure Total Time is at least as long as the longest transition list you have set up, so all the transitions can run.

6.9. Graphics Styles

A graphic style is a collection of attributes that control a graphic's display. Every attribute is a potential part of a given style. Each new graphic style retains the object hierarchy to ensure that attributes are applied to relevant portions of the graphic and conflicting values are re-applied logically. (For instance, a graphic may plot two functions and contain several objects of the same type.)

When you apply a style to a graphic, it overwrites corresponding attributes, but you may change the values after you have applied a style.

In this Section

6.9.1. Graphics Style Menu

You can open the Graphics Style menu from the Graphics Menu Bar (Section 4.15. Graphics Menu). It contains the following items:

Graphics Styles Menu Item	Description
Capture Current Style	Opens a Dialog to capture the current graphic as a style.
Edit/Apply Style	Allows you to edit the attributes in a style. See Section 6.9.5. Editing Graphics Styles.

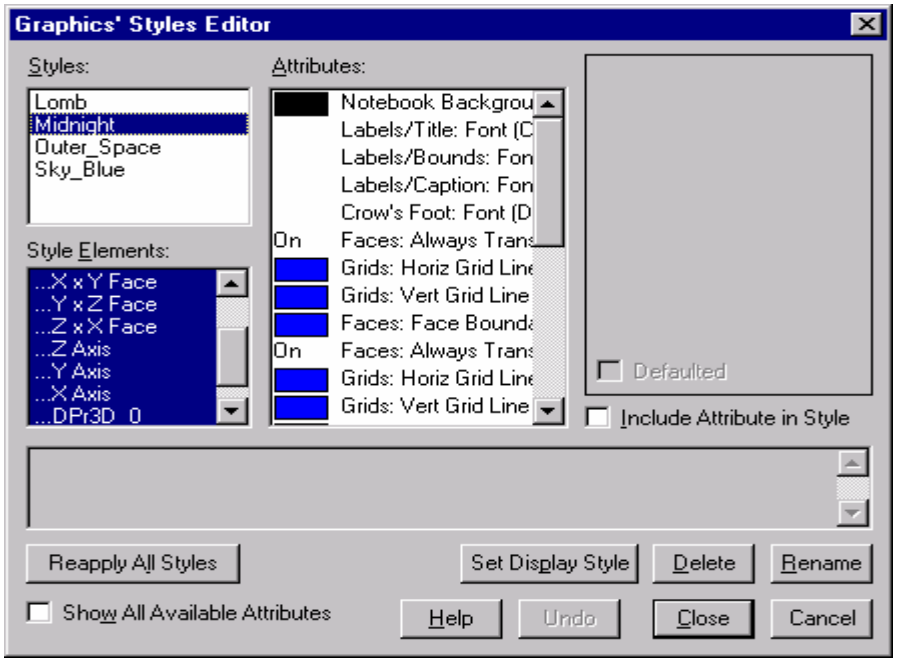


Figure 32 Graphics Styles

Graphics Styles Menu Item	Description
Capture Temporary Style	Captures the attributes of the current graphics as a temporary style to apply.
Apply Temporary Style	Applies the temporary style.
Reapply All Styles	Reapplies the most recently applied style to each graphic style in a notebook. So, if graphic section 1 uses Style A and graphic section 2 uses style B, this command re-applies Style A to section 1 and Style B to section 2.
Undo Style Application	Undoes the most recently applied style to the current graphic section.

6.9.2. Creating a Graphics Style

To create a graphics style:

- Create a graphic of the type you want to use as a model for a certain style.
- Give the graphic the attributes you want.
- Choose "capture style," from the *Styles* submenu of the *Graphics* menu (or from the pop-up menu in the graphic section). You will be prompted for a name. Create a name, or choose the name of a current style from the pull down list. If you use an existing style name, the style you have just created will replace the existing style.

When you capture a style from a graphic, the name you enter will automatically become the style for that graphic section.

You can find a number of pre-defined styles in the **NORMAL.MFE** notebook in the MFE\Styles directory. **Normal** is also the default value of the Style Sheet attribute. Current pre-defined styles for Macsyma include: Scientific2D, Scientific3D Slide2D, Slide 3D, BlackWhite2D, Midnight, outer_space and sky_blue.

You can store a graphics style in **NORMAL.MFE** by:

- opening **NORMAL.MFE**,
- copying the graphic
- capturing the style
- erasing the graphics section
- storing **NORMAL.MFE**.

6.9.3. Applying a Graphics Style

To apply a style, select the section you want to change and choose *Edit/Apply Style* from the Styles submenu of the Graphics menu or the popup menu in that graphic section. Choose the style you want, and click the *Set Display Style* button. The dialog automatically selects the style most recently used for that section. Choose another style or close the dialog is you want to keep the selected style.

6.9.4. Reapplying a Graphics Style

"Reapply All Styles" globally re-applies graphics styles to reapplying graphics sections in the entire notebook. It automatically reapplies previously assigned styles to all graphics sections.

6.9.5. Editing Graphics Styles

Editing styles brings up the same dialog box as "Applying a style." Begin by selecting a style, then change the style elements as you wish. The procedure is like changing a graphics attribute, except that:

- Each selected style is stored separately.
- The "Style Elements" list acts like the objects list in the attributes dialog box. Each element has various attributes attached to it.
- Changing a style's attributes doesn't affect previously created graphics. You must reapply the style to change the graphic.
- You have access to two check boxes, "Show All Available Attributes" and "Include Attribute in Style."
- You have access to different buttons.

1. The "Reapply All Styles" button acts just like the menu item listed above.
2. The "Delete" button deletes a style.
3. The "Rename" button renames a style.

The *Show All Available Attributes* check box displays only attributes that are part of a currently selected style element. The values of the *Include Attribute in Style* check box changes as you change selected attribute. See Figure 32 on page 66.

The *Include Attribute in St*yle check box displays a currently selected attribute that will overwrite a similar graphic attribute. Only those attributes for which this box is checked normally show up; Turn on *Show all available attributes* to see all the possibilities. See Figure 32 on page 66.

6.9.6. General Notes on Graphics Styles

Be sure to set certain attributes at the time you create a new graphics style. Specifically, if you want the section background color to be part of a style, make it so initially. Create multiple presenters when you create the style. (You cannot change the number of presenters later.)

If you need to make changes later, you must create a new graphic (with the appropriate new number of presenters), apply the style, make the changes you want and recapture the style.

Apply styles captured from 2D graphics to 2D graphics only. Apply styles captured from 3D graphics to 3D graphics only. If you try to "cross-apply" a style, axis attributes may not apply correctly, and Presenter attributes won't apply at all.

Chapter 7. Settable Attributes

7.1. In This Chapter

The attributes appear in the *File-Options*, *File-Option Defaults*, and *Graphics Attributes* Dialogs.

Select the attribute category at the bottom of the *File Options* and the *File Option Defaults* Dialogs. Categories group related attributes together.

Some attributes are available only when Attributes: Expert Mode is On., The default Standard Mode attributes are usually sufficient.

Attribute Expert Mode (default=Off)

This flag accesses the full range of system attributes. Expert attributes are available only when this mode is on. Choose *Expert* in the *All* grouping of attributes in the File-Option Defaults Dialog.

To change the setting of Attributes: Expert Mode click *File-Option Defaults*, set the category to All, and select the *Expert Mode* attribute in the dialog. The setting is saved for future sessions.

7.2. Notebook Attributes

Notebook attributes control the general appearance and behavior of a notebook, including margins, section spacing, and decorations. To edit them:

- in the current notebook, click *File-Options* and select Notebook.

- by default in all future notebooks, click *File-Option Defaults* and select the category Notebook.

Notebook Attributes	Description
Style Sheet	Specifies the style sheet for this notebook. If this string contains no directory separator characters, then the path \<*InstallDir*>\MFE\Styles is added before the name. Otherwise, the string is treated as a path relative to the directory from which current notebook was read. The MFE extension is always used.
Autoload Notebook Name	Specifies the file pathname of a notebook that loads when the MFE starts. (Default:)
Collapsed Section Bracket Color	Controls the color of collapsed section brackets. (Default: Blue)
Collapsed Section Font	Controls the font and color of collapsed section text. (Default: Times New Roman 12)
DataViewer Section Height (inches)	Sets default height of DataViewer sections. (Default: 2)
Font: Formatted Link	Controls the font and color of hypertext links. Defaults to Appearance underlined green; takes other attributes from the surrounding text. (Default: Times New Roman 12)
Graphic Height (inches)	Sets the default height of graphics. (Default: 4)
Interaction Separator Size	Sets the height of the horizontal bar at the end of each Interaction section, in screen units. (Default: 1)
Background Color	Controls the background color of the active notebook area. (Default: White)
Border Enabled	Controls notebook border display, i. e., the book edge effect at the top and right and the spiral-bound effect at the left.) The spiral effect can be disabled separately. (Default: On)
Border Top Size	Sets the height of the top notebook edge effect, in screen units. (Default: 10)
Border Right Size	Sets the width of the right notebook border effect, in screen units. (Default: 15)
Border Lines	Controls the number of apparent “pages” in the top and right notebook border effect. (Default: 5)
Border Line Width	Controls the width of each “page” in the top and right notebook border effect, in screen units. (Default: 1)
Border BK Color	Controls the background color of the top and right notebook border. (Default: White)
Border FG Color	Controls the color of the “pages” in the top and right notebook border. (Default: Dark Gray)
Border Spiral	Controls the display of the spiral notebook. Active only when notebook borders are also enabled. (Default: On)
Border Spiral Name	Sets name of the bitmap used to draw the notebook spiral effect. Currently, two bitmaps are available: (Default: Default Spiral) ■ *Default Spiral:* Spiral with yellow background and punched holes. ■ *Spiral Redline:* Spiral with blue background, punched holes, and red line at right.

Execute In Place	Places an Output section(s) immediately after a re-executed Input section. When Off, the re-executed Output section(s) appears at the end of the notebook. (Default: On)

Notebook Attributes	**Description**
Execute New Section In Place	Places an Output section(s) at the end of the notebook. When On, the Output section(s) appears immediately after the re-executed Input section. (Default: Off)
Execute Watch	Scrolls the notebook during execution so that you can view new sections. (Default: On)
Font: Formatted Text Normal	The font used to display a Text section. See *Font Controls*, page 45, for an overview of changing notebook fonts. (Default: Times New Roman 12)
Formatting Width (inches)	Controls the width of each section. The default value 0 causes the current value of notebook Width to be used as the formatting width. See also *Notebook Width, Math: Formatting Width, Math: Centering Width.* (Default: 0)
Width (inches)	Controls the total width of the notebook, including borders. You can set the width of the entire notebook or only one selected section. See also *Math: Centering Width, Math: Formatting Width, Notebook Formatting Width.* (Default: 7.5)
Section Bracket At Toplevel	Shows when one large section bracket refers to the entire notebook. Useful if you often need to select the entire notebook. (Default: Off)
Section Brackets Enabled	Indicates that the right-hand section brackets are drawn. (Default: On)
Section Bracket Size	Sets the width of the right-hand section brackets, in screen units. (Default: 4)
Section Bracket Color	Sets the color of the right-hand section brackets. (Default: Red)
Section Separator Color	Sets the color of the interaction separator. (Default: Black)
Selection Border Color	Sets the color of the border used to indicate a selected section. (Default: Red)
Font: Non-Math Text	Sets the font used for non-fancy output. Controls the text font for a batch file. (Default: Times New Roman 12)
Windows Status Bar Position	Controls status bar position and visibility. (Default: Bottom)
Window Tool Bar Position	Controls toolbar position and visibility. (Default: Top)
Math Engine Auto Start	Controls whether the Macsyma math engine starts automatically when you invoke MFE. You can override this setting with command line switches. (Default: Off)
Math Engine Maximize	Puts the notebook connected to the Macsyma math engine on Autostart in autostart mode. (Default: Off)
Hide Math Engine	Indicates when the icon representing the Macsyma math engine is visible. This flag should be off except when you are debugging Macsyma math engine start-up problems. Under Windows 3.1 or 3.11, this attribute is *Win16: Hide Math Engine*. (Default: On)
Win32: Math Engine Run Priority	Sets the run priority of the math engine task to average in its class. (Default: 0)
Win32: Math Engine Start Priority	Sets the run priority of the math engine task to highest in its class at start time. (Default: 1)

7.3. Math Attributes

Math attributes control the appearance of formatted mathematical output. The term *fancy* denotes formatted, graphically drawn mathematical output. A related Macsyma option variable is fancy_echo.

fancy_echo [default=false]

If fancy_echo is True, input appears in a section with graphically drawn mathematical output. Although a(c#) may be echoed, this is actually an Output section, and you cannot re-execute it. The Input section can be edited or deleted. You can save or print the notebook with only the fancy echo of input. If you have also enabled fancy output, the resulting notebook will have both fancy Input and Output sections. See fancy_display in the *Fancy Display Facility* section in the *Macsyma Mathematics and System Reference Manual*.

To edit:

- Click *Edit-Section Properties* in a selected Input or Output section.
- Click *File-Options* and select the category Math for all Input and Output sections in the current notebook.
- Click *File-Option Defaults* and select the category Math for all Input and Output sections in all future notebooks,

Math Attribute	Description
Centering Width (Inches)	Controls the widths from the left margin within which math expressions are centered in an Output section. The default (0) causes the current value of Math: Formatting Width to be used as the centering width. (Default: 0)
Formatting Width (Inches)	Controls the width of display of math expressions in an Output section. The default (0) causes the current value of Notebook: Formatting Width to be used as the formatting width. (Default: 0)
Number Width %	Controls the percentage of the notebook width that a long number can occupy before being split into multiple lines. You can adjust this attribute on a per section basis if a particular expression contains long numbers and is too wide to fit into a notebook. (Default: 60)
Number Max Lines	Controls the maximum number of lines into which a long number will be broken. (Default: 1024)
Expression Width %	Controls the percentage of the notebook width that a math expression or subexpression can occupy before being split vertically. You can adjust this attribute on a per section basis if a particular expression is too wide to fit into a notebook. (Default: 80)
Expression Max Lines	Controls the maximum number of lines into which a wide math expression will be split. (Default: 1024)
Short Fraction	Controls the length in characters of a number that can be displayed as a short fraction. (Default: 4)
Left Margin	Controls the space left for the label to the left of the expression, in screen units in math Input and Output sections. (Default: 0)

Math Attribute	Description
Max Output Height (Inches)	Sets the maximum height of an Output section before vertical scrolling begins. (Default: 99)
Label Position	Positions the label within the left margin of an Input or Output section. (Default: Left)
Label Offset	Controls the offset distance of the label from the left edge of the Input or Output section. (Default: 0)
Font-Output	Sets the font used to display math output expressions. The face name and point sizes are used; other font attributes are ignored. See *Font Controls*, page 45, for an overview of how to edit fonts in a notebook. (Default: Times New Roman 12)
Font-Input	Sets the base font used to display math input expressions. The face name and point sizes are used; other font attributes are ignored. See *Font Controls*, page 45, for an overview of how to edit fonts in a notebook. (Default: Times New Roman 12)
Fancy to Clipboard	Controls copying of formatted (fancy) math expressions to the clipboard. When Off, only the linear textual representation is copied. Use with caution; pasting fancy expressions may cause software instability. (Default: Off)
Fancy Input Enable	Controls input of formatted (fancy) math expressions from the keyboard. Use with caution; input of fancy expressions may cause software instability. (Default: Off)
Font-Non-math text	Sets the font used to display non-fancy output from the Macsyma math engine. Due to inconsistencies within Windows, you may need to change the size of this font to match the apparent size of fancy math expressions. It should only need to be set once, via the File-Option Defaults Dialog. (Default: Times New Roman 12)

7.4. Graphics Attributes

The Graphics Attributes Editor Dialog looks like:

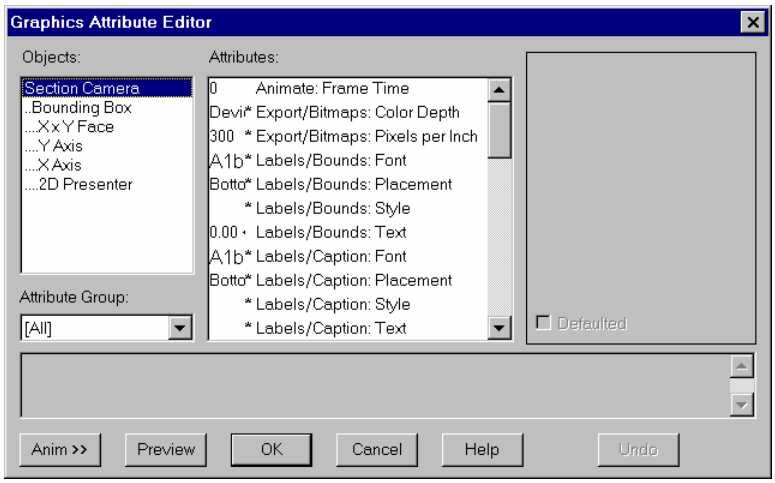


Figure 33 Graphics Attributes

You can also access Graphics Attributes from the *File-Options* or *File-Options Default* under the category Graphics.

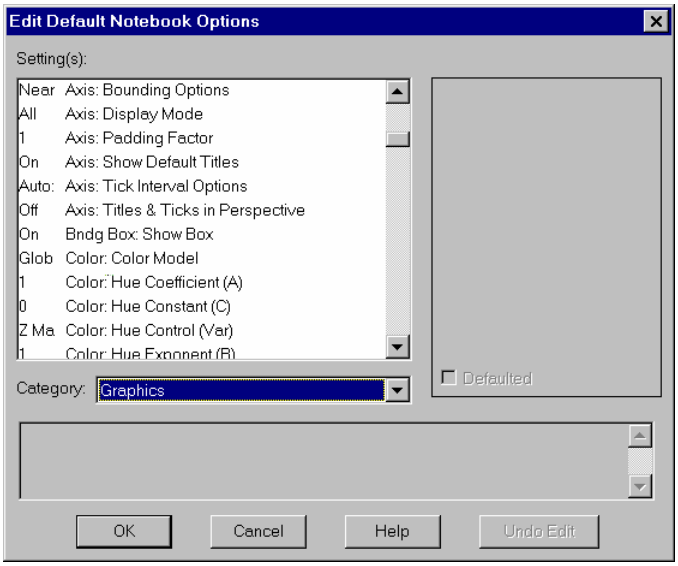


Figure 34 Options Default Graphics Dialog

You can alter the appearance of graphics in a notebook by changing Graphics attributes without regenerating the graphics from the Macsyma math engine or the PDEase Engine. You can also change graphics attributes through dialog boxes. For more information, see *Chapter 6. Using Dialogs*, page 57.

7.4.1. Camera View Attributes

- *7.4.1.1. Export Attributes*
- *7.4.1.2. Scale Attributes*

- *7.4.1.3. View Attributes*

7.4.1.1. Export Attributes

When you select a graphic, you can export it to a file in BMP, GIF, RLE, or PCX format. Clicking *Graphics-Export* displays a dialog that looks like:

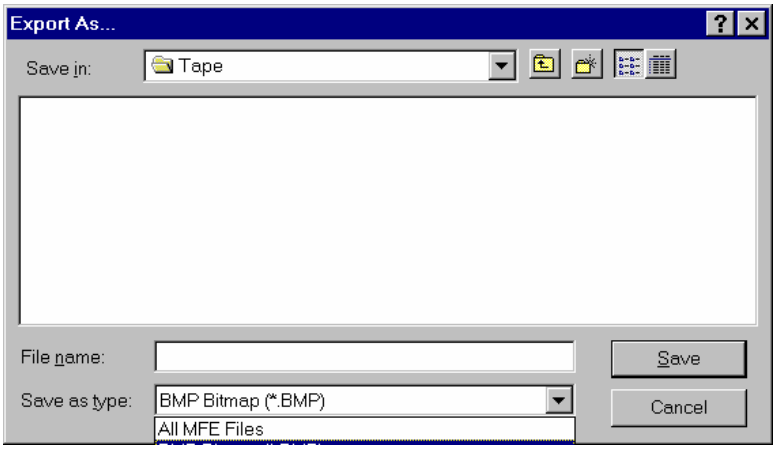


Figure 35 Data Export Dialog

You can also edit Export attributes by clicking *Graphics Attributes.* The Dialog looks like:

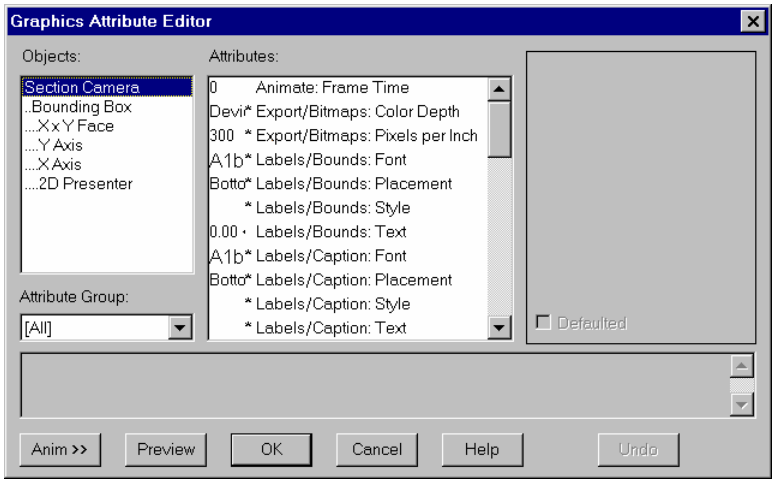


Figure 36 Graphics Attributes

Export Attributes	Description
Bitmap Color Depth	Can be 16, 2, 256, Device, or True Color. You can use the Graphics Attribute Dialog to set this value. (Default: Device)
Pixels per inch	Resolution. (Default: 300)

7.4.1.2. Scale Attributes

Scale attributes affect the section properties used by a graphical image.

Scale Attributes	Description
Initial Height %	Sets percentage of section height used by graphic. (Default: 85)
Initial Width %	Sets percentage of section width used by graphic. (Default: 85)
Rescale on View Change	Rescales calculations when the view changes. Graphics do not normally rescale whenever the camera and/or view position change. (Default: Off)
Rescale Tolerance	Determines rescaling threshold in quality rendering mode. Rescaling is sometimes necessary when graphic labels, axis titles, or other text would bleed off the edge of the section. A lower number triggers rescaling more easily than a higher one. Rescaling slows re-display slightly and is never performed in fast rendering mode. The trade-off is that text will sometimes be clipped in fast mode. (Default: 30)
Window	Controls scaling of graphic in a section's display area. (Default: Isotropic) ▪ *Isotropic:* Preserve aspect ratio. ▪ *Fit to pane:* Scale width and height separately to achieve best fit. ▪ *Fit to width:* Scales to assure fit side to side. ▪ *Fit to height:* Scales to assure fit top to bottom.

Scale Attributes	Description
World Scaling Mode	Determines what scaling, if any, occurs before mapping data into the camera's view space. It is preferable to use the *World Scaling* menu item in the Graphics menu to control this setting. (Default: None) The Macsyma equalscale option variable translates into these scalings in MFE:

Dimensions	EQUALSCALE	World Scaling	Window Scaling
2D	FALSE	Normalized	Fit to Pane
2D	TRUE	None	Isotropic
3D	FALSE	Normalized	Isotropic
3D	TRUE	None	Isotropic

World Scaling Multipliers	Multipliers used when World Scaling Mode is User Specified. (Default: (1,1,1))
Best Guess World Scaling Threshold	*Best Guess world scaling mode* determines the maximum size ratio between axes before world scaling is applied to one or more axes.

7.4.1.3. *View Attributes*

View Attributes	Description
Camera Position	Sets camera position in scaled world space. See previous entry regarding scaled vs. unscaled world space. You can also use the Camera View Dialog to set the value View Camera. (Default: (0,0,0))
Camera Roll	Controls camera roll angle expressed in radians. The Camera View Dialog can be also be used to set this value. (Default: 0)
Center Position	Centers the camera view in scaled world space. When World Scaling is Off, scaled world space is identical to the "data space" (unscaled world space) of the graphic. When World Scaling is Normalized, the graphic's data space is scaled into a 1x1x1 cube, and camera and view center positions are expressed in terms of this normalized space. You can also use the Camera View to set this value. (Default: (0,0,0))
Default View	Sets default camera view when none is supplied. Macsyma-generated graphics always supply camera and center positions and do not use this setting. (Default: 45/45 to center)
Focal Length	Sets camera focal length. This value is a zoom control on the image. A value of 50 is neutral. Larger values reduce the image. Smaller values enlarge it. You can also use the Camera View Dialog to set this value. (Default: 50)
Perspective	Adds perspective to graphic. You can also toggle this control from the Perspective item in the Graphics menu. See *6.4. Camera View Dialog*, page 59, for a convenient way to set many View attributes. (Default: On)
Optimize When Needed	Adjusts World Scaling and viewing position automatically when the data in a graphic changes significantly.

7.4.2. Filter/Box Attributes

View Attributes	Description
Max Total Points	Applies box filter to limit the number of total points in a graphic to a value close to this setting. Set to 0 to disable box filtering.
X Axis Points	Applies box filter along the X direction when the number of points exceeds this limit. Set to 0 to disable.
Y Axis Points	Applies box filter along the Y direction when the number of points exceeds this limit. Set to 0 to disable.
3D Graphic Max Points	Limits the number of points a displayed graphic can contain.
Allowed AG Growth	Represents the Over Box maximum multiple of new points adaptive gridding can add over the box filter limit.

7.4.3. Light and Render Attributes

7.4.3.1. Light Attributes

Light attributes allow you to change ambient light and color.

Light Attributes	Description
Ambient Light Color	Sets basic lighting level and color of a graphic. Use the camera and world lights for directional lighting effects. (Default: Dark Gray)
Camera Light 1 Color	Sets colors for camera light 1. (Default: White)
Camera Light 2 Color	Sets colors for camera light 2. (Default: Black)
Camera Light 1 Position	Sets position for camera light 1. (Default: (0,0,0))
Camera Light 2 Position	Sets position for camera lights 1 and 2, in camera space. In camera space the camera is at (0,0,0) and the view center at (x,0,0), where x is a positive value. When looking from the camera towards the view center, right is positive y, left negative y, up positive z, and down negative z. Camera lights move with the camera when its position is changed. (Default: (0,0,0))
Default Positioning Mode	Sets default or initial positions for the four camera lights when a graphic is created. (Default: Manual)
World Light 1 Color	Sets colors for world light 1. (Default: (0, 160, 0))
World Light 2 Color	Sets colors for world light 2. (Default: (0, 160, 0))

Light Attributes	Description
World Light 1 Position	Sets position for world light 1. (Default: (0,0,0))
World Light 2 Position	Sets positions for world lights 1 and 2. These positions are in scaled world space. See View: Center Position for a discussion of scaled world space. (Default: (0,0,0))

7.4.3.2. Render Attributes

Render attributes affect graphical rendering between screen image and bitmaps.

Render Attributes	Description
Always Best Colors	Optimizes background palette use on 256 color systems. (Default: On)
Axis Grid Function	Permits choosing axis grid scaling: linear, natural log, log10 or log2 (Default: Linear)
Font Prop. Factor	Leave at default setting. (Default: 20)
Font Prop. Minimum	Leave at default setting. (Default: 0.3)
Invisible Redraw	Renders graphic into a bitmap and displays the bitmap. Some Windows display cards may produce rendering errors when this mode is Off (the default). Observed errors have included inaccurate colors on some surface polygons and random transparent polygons. If you observe any of these problems, turn g Invisible Redraw on. (Default: Off)
Label Padding	Adds space between text and ticks. If tick marks are crowding or overwriting their text, try increasing this value. (Default: 3)
Speed vs. Quality	Trades rendering speed for quality. This control mostly affects the appearance of graphic labels. Quality mode does extra calculations to assure that the graphic is scaled to display all text. It also suppresses the display of some labels in viewing orientations where labels would otherwise overwrite one another. (Default: Fast speed/Lower quality)
Cache Animation Bitmaps	Speeds up graphics display (Default: On)

7.4.3.3. Label Attributes

Decoration (or Label) attributes affect Line decorations. All types lets you edit all text labels in the plot, except axis titles, which are controlled in the Bounding Box & Axes Dialog (page 80).

- *Plot title:* Settable attributes include title text, font, and. You can set the title text when you generate a plot.
- *Bounds box:* Displays the maximum and minimum value of each coordinate. Settable attributes for the bounds box include the text, font, and placement of the bounds box. You can turn the bounds box on or off when you generate a plot.
- *Contour labels, in contour plots:* Settable attributes are the text, font, and of the contour labels. You can turn the contour labels on or off when you generate a plot sing the Macsyma **labelcontours** option

variable.

- *Text caption:* Settable attributes include text, font, and placement.

Label Attributes	Description
Labels/Default Font	Default font for graphic text (i.e., title, caption, bounds, and contour label). (Default: Arial 10)
Labels/Bounds: Font	Font for bounds text. (Default: Arial 10)
Labels/Bounds: Placement	Placement for bounds text. Can also be used to hide the text. (Default: Hide)
Labels/Bounds: Text	Bounds text. Automatically generated by Macsyma.
Labels/ Caption Font	Font for caption text. (Default: Arial 10)
Labels/Caption Placement	Placement for caption text. Can also be used to hide the text. (Default: Hide)
Labels/Caption Text	Graphic caption text. (Default:)
Labels/Contours Font	Font for contour label text. (Default: Arial 10)
Labels/Contours Placement	Placement for contour label text. Can also be used to hide the text. (Default: Hide)
Labels/Contours Text	Contour label text. Automatically generated by Macsyma when producing contour plots. (Default:)
Labels/Title Text	Graphic title text. (Default:)
Labels/Title Font	Font for title text. (Default: Arial 10)
Labels/Title Placement	Placement for title text. Can also be used to hide the text. Text strings for titles, bounds, captions, and contour labels recognize two special control sequences. (Default: Hide) ▪ *n:* Introduces a line break into the title text. ▪ *cTTRRGGBB:* This sequence can be placed only at the beginning of a line (either the first line or immediately following an **n** sequence). It controls the display color of the text on the line. The TT, RR, GG, and BB represent four two-digit hexadecimal fields with the following interpretations: TT - Color type: 01=RGB, 02=IHS RR - Red value for RGB, Intensity value for IHS GG - Green value for RGB, Hue for IHS (0 is pure red) BB - Blue value for RGB, Saturation for IHS.

7.4.3.4. Bounding Box and Axis Attributes

- *7.4.3.4.1. Axis Attributes*
- *7.4.3.4.2. Bounding Box Attributes*
- *7.4.3.4.3. Crow's Foot Attributes*

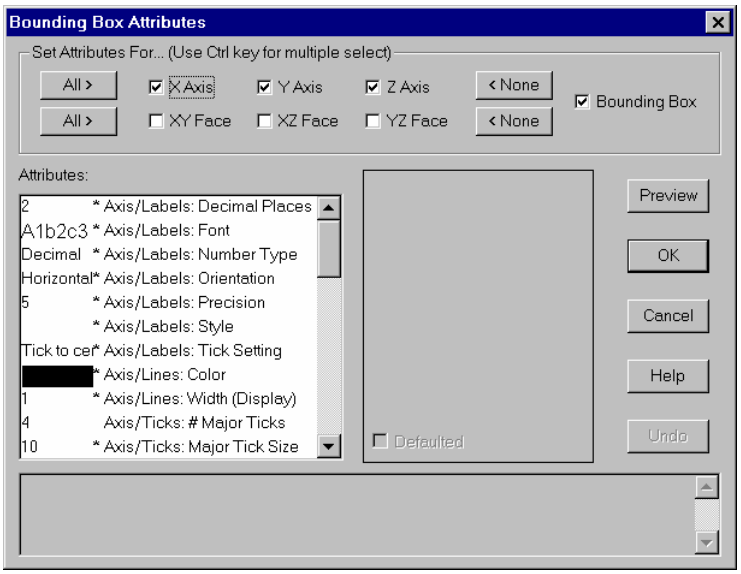


Figure 37 Bounding Box Attributes

7.4.3.4.1. Axis Attributes

Axis attributes are the settable attributes affecting axes in the bounding box.

Axis Attributes	Description
Bounding Options	Controls bounding box size in relation to the data it contains. (Default: Nearest Minor Tick). The choices are: ■ *Nearest Minor Tick:* Axis extent is data extent, possibly rounded up to the nearest minor tick. ■ *Nearest Major Tick:* Axis extent is data extent, possibly rounded up to nearest major tick. ■ *Exact to Data:* Axis extent is exactly the data extent. ■ *User Specified:* Axis extent set by Axis: Minimum and Axis: Maximum.
Padding Factor	Applies padding factor to axis. For example, a value of 1.1 will cause the axis extent to be 10% larger than the size that would otherwise have been calculated by the current *Axis: Bounding Options. Disabled when User Specified* bounding option is selected. (Default 1.1)
Display Mode	Controls which axis elements are displayed (axis line, ticks, labels, and title). (Default: All)
Minimum	Sets axis minimum value. Only applicable when Axis: Bounding Options is set to User Specified. (Default: 0)
Maximum	Sets axis maximum value. Only applicable when Axis: Bounding Options is set to User Specified. (Default: 0)
Tick Interval Options	Defines number of minor ticks per major tick, and total number of major ticks per axis. The User Specified setting uses the values in #Major Ticks and Minor Ticks

Per Major. Otherwise, Macsyma chooses reasonable values based on the selected Auto setting. Auto settings tries to set tick intervals to match the number of major ticks requested in the #Major Ticks attribute. (Default: Auto: 100—5 50—5 25—5 20—4 10—5)

The ranges are scaled to the appropriate power of ten:

- Auto: 100—5 50—5 25—5 20—4 10—5 4 minor/major if majors every 100, 50, 25, or 10; 4 if every 20.
- Auto: 100—2 50—2 20—2 10—2 2 if every 100, 50, 20, or 10.
- Auto: 100—4 50—4 25—2 12.5—1 10—4 4 if every 100, 50, or 10; 2 if every 25; 1 if every 12.5
- Auto: 1—3 1/3—3 1/6—3 3 if every 1, 1/3, or 1/6.

Axis Attributes	**Description**
Labels: Decimal Places	Sets number of decimal digits displayed in axis labels; sometimes called rounding. (Default: 2)
Labels: Font	Sets font for axis tick labels. (Default: Arial 10)
Labels: Number Type	Determines number type of axis labels. (Default: Decimal) One of: ■ *Decimal:* Number in decimal representation, e.g. 1.00. ■ *Scientific:* Number in scientific notation, e.g., 1.24*10e5. ■ *Engineering:* Same as Scientific, except exponent is always a multiple of 3. ■ *Percent:* Number as a percent. For example, .235 is shown as 23.5%. ■ *Time: SS.T:* Effectively the same as Decimal. ■ *Time: MM:SS.T:* Number as a time in minutes and seconds. ■ *Time: HH:MM:SS.T:* Number as a time in hours, minutes, and seconds.
Labels: Precision	Sets value of numeric precision axis labels. (Default: 10) ***Note:*** This is not the same as rounding.
Labels: Orientation	Controls orientation of axis tick labels. (Default: Horizontal)
Labels: Tick Setting	Sets ticks to No Tick or: (Default: No Tick) ■ *To Center:* Tick is drawn to the center point of text. ■ *To Nearest:* Tick is drawn to nearest corner or midpoint of text string, whichever is nearer. ■ *To Middle:* Tick is drawn to the nearest midpoint. ■ *To Corner:* Tick is drawn to the nearest corner.
Ticks: Major Tick Size	Sets length of major ticks in points. (Default: 15)
Ticks: Minor Tick Size	Sets length of minor ticks in points. (Default: 5)
Ticks: Minor Ticks Per Major	Sets number of minor ticks per major. This setting works when Axis: Tick Interval Options is set to User Specified. (Default: 2)
Major Ticks	Controls number of major ticks displayed. When Axis: Tick Interval Options is set to User Specified, then exactly this number of major ticks will be displayed. If Tick Intervals is on an Auto setting, this number is used as a guideline, but the actual number of ticks shown may be slightly more or less. (Default: 5)

Axis Attributes	Description
Title: Exponent in Title	Appends an exponent indicator to the axis title, X Axis (*10e5) for example. A useful control when the axis range is very large or small. (Default: Off)
Title: Font	Sets font for axis title. (Default: Arial 10)
Title: Offset from Axis	Offsets title from axis . (Default: 50 points)
Title: Orientation	Orients axis title text. (Default: Horizontal)
Title: Text	Adds axis title text. (Default:)
Title: Tick Setting	Adds tick drawn from the axis to the title text. See also *Axis/Labels: Tick Settings*. (Default: No tick)

7.4.3.4.2. Bounding Box Attributes

Bounding Box attributes are the settable attributes affecting bounding boxes for graphics.

Bounding Box Attributes	Description
Always Show Lines	Shows bounding box edges, even around transparent faces. (Default: Off)
Show Box	Determines when bounding box is displayed. Graphic data still displays when bounding box is Off. (Default: On)
Titles/Ticks in Perspective	Renders axis titles and ticks with perspective. (Default: Off)

7.4.3.4.3. Crow's Foot Attributes

Crow's Foot attributes are the settable attributes affecting three-dimensional axes orientation indicators.

Crow's Foot Attributes	Description
Placement	Sets Crow's Foot placement and visibility. (Default: Hide)
Size	Sets Crow's Foot point size. (Default: 18)

7.4.3.5. Surface, Line, and Point Attributes

- *7.4.3.6. Faces Attributes*
- *7.4.3.7. Grids Attributes*
- *7.4.3.8. Lines Attributes*
- *7.4.3.9. Color Attributes*
- *7.4.3.10. Cursor Attributes*
- *7.4.3.11. Points Attributes*
- *7.4.3.12. Surface Attributes*
- *7.4.3.13. Wireframe Attributes*
- *7.4.3.14. Vector Attributes*

- *7.4.3.15. Clip Attributes*

Access these attributes by opening the Surface, Line, and Points Dialog or clicking the Surface/Line toolbar button. The Surface, Line, and Points Dialog looks like:

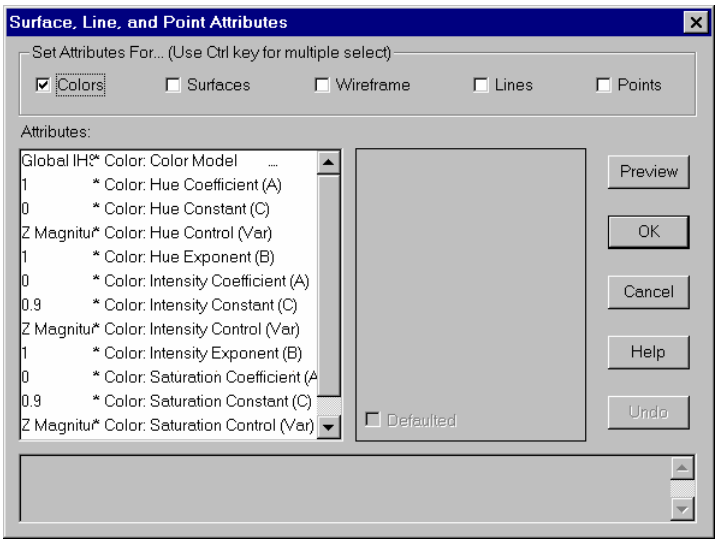


Figure 38 Surface Lines and Points Dialog

7.4.3.6. Faces Attributes

Faces attributes are the settable attributes affecting three-dimensional faces in graphics.

Faces Attributes	Description
Always Transparent	Forces bounding box faces to be transparent. Grids, lines and face presenters are controlled separately, so this feature can produce an interesting *cage* effect. (Default: Off)
Face Boundary Color	Sets bounding box face boundary line color. (Default: Black)
Face Boundary Width	Sets bounding box face boundary line width. (Default: 0)
Face Color	Sets bounding box face color. (Default: Light gray)
3D Cursor Always Crosses	Extends 3D cursors all the way from hit point to face, even when the face is transparent. Otherwise, cursor lines extend only from hit point to opaque faces. See also *Cursors Attributes*, page 86. (Default: On)
3D Cursor Mode	Creates “cross hair” lines where the 3D cursor touches a face. Controls which cross hair lines are displayed, if any. (Default: None)

7.4.3.7. Grids Attributes

Grids attributes control grids drawn with graphical images.

Grids Attributes	Description

Always Show	Shows grids, even when their face is transparent. (Default: Off)
Horiz Grid Line Color	Sets the color for horizontal grid lines. (Default: Black)
Horiz Grid Line Style	Sets the style for horizontal grid lines. Currently a standard Windows line style. (Default: Solid)
Horiz Major Grids Thicker	Makes horizontal major grid lines thicker than horizontal minor grid lines. (Default: 0)
Show Major Grid Lines	Controls display of major grid lines, i.e. the lines drawn between labeled axis ticks. (Default: Both)
Show Minor Grid Lines	Controls display of minor grid lines, i.e. the lines drawn between minor ticks. (Default: None)
Vert Grid Line Color	Sets the color for vertical grid lines. (Default: Black)
Vert Grid Line Style	Sets the style for vertical grid lines. Currently a standard Windows line style. (Default: Solid)
Vert Major Grids Thicker	Makes vertical major grid lines thicker than horizontal minor grid lines. (Default: 0)

7.4.3.8. Lines Attributes

Line attributes control line properties in graphical images.

Lines Attributes	Description
Color	Sets line color for 2D lines using constant color and bounding box outline lines. (Default: Black)
Constant Color	Renders lines in 2D graphs in constant color. (Default: Off)
Line Background Color	Determines background color for lines and the color used to draw the "breaks" in lines when Lines: Style is set to a non-Solid style. (Default: Black)
Style	Sets line style for 2D graphs. Currently offers the standard Windows styles. (Default: Solid)
Width (Display)	Sets line width for 2D lines using constant color and bounding box outline lines. (Default: x)

7.4.3.9. Color Attributes

Color attributes control color properties in graphics.

Color Attributes	Description
Color Model	Selects the prevailing color model for graphic surfaces, lines, and points. These elements can also be assigned constant colors that override the color model. See also: *Surface: Front Face Constant Color; Surface: Backface Constant Color; Lines: Constant Color; Points: In Color.* The color model determines the *base* color of the element. For points and lines the

base color is the same as the display color. Lighting can also the affect color. (Default: IHS: $A*Var^B + C$)

There are four color model options:

- *IHS = A*Var^B+C:* An IHS (Intensity, Hue, Saturation) model that allows you to control each color parameter independently by using an equation of the form:
  - Intensity = AI*VarI^BI+CI
  - Hue = AH*VarH^BH+CH
  - Saturation = AS*VarS^BS+CS

The nine constants AI, BI, CI, etc., are individually set by the following attributes. The three "control Variables, " VarI, VarH, and VarS, can be independently derived from the X, Y, or Z value of the data point or its vector norm from (0,0,0). All three color parameters are normalized to the range 0.0 to 1.0. Hue will "cycle" if it exceeds the range (e.g., a hue of 1.3 is the same as 0.3).

- *Z-Based Hue:* Hue is derived from Z value of the data point running through one cycle of the color space over the Z extent of the data. Intensity and saturation are constant at 0.9.
- *Assigned Mesh Color:* Uses the surface element color assigned by Macsyma. Currently applies only to .PLT files. A uniform gray color is assigned for other graphic sources.
- *Avg. Vertex Color:* Plots generated by Macsyma encode color on a per vertex basis. This mode averages the colors of the vertices of each surface element to determine its color. The present per vertex encoding is IHS, so the average is done in IHS color space.

Color Attributes	Description
Hue Coefficient (A):	(Default: 1)
Hue Constant (C):	(Default: 0)
Hue Control (Var):	(Default: Z magnitude)
Hue Exponent (B):	(Default: 1)
Saturation Coefficient (A):	(Default: 0)
Saturation Constant (C):	(Default: 0.9)
Saturation Control (Var):	(Default: Z magnitude)
Saturation Exponent (B):	(Default: 1)
Intensity Coefficient (A):	(Default: 0)
Intensity Constant (C):	(Default: 0.9)
Intensity Control (Var):	(Default: Z magnitude)
Intensity Exponent (B):	(Default: 1)

7.4.3.10. Cursor Attributes

Cursor attributes control how cursors work with graphics. When you click your left mouse button on a three-

dimensional graphic in a notebook, the (x, y, z) coordinates of the point where you clicked appear in the status bar at the bottom of the MFE window. Cursor lines appear to help you visualize the selected point in the coordinate system. You can turn the cursor lines off by clicking on the background in the same Graphic section.

A sample three-dimensional graphic looks like:

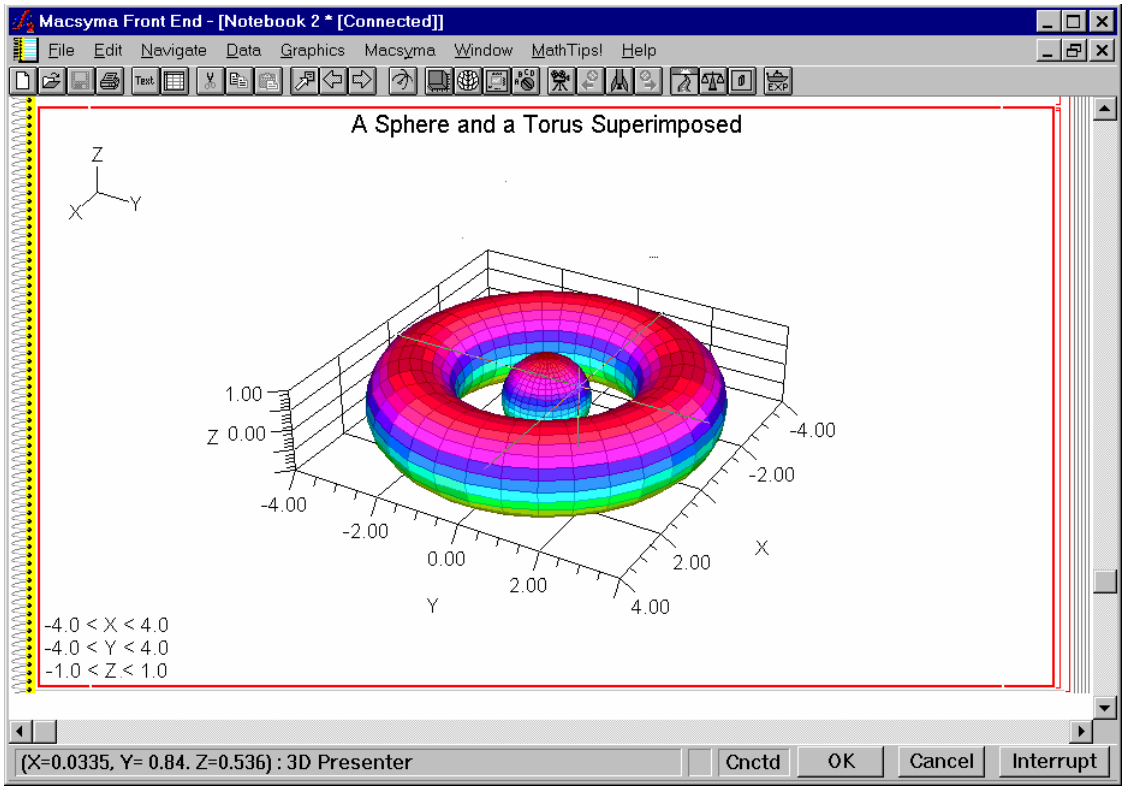


Figure 39a Sphere and Torus 3D Plot

Shift+ Left Click on a three-dimensional graphic changes the center of view to the cursor location. You can see the 3D Presenter coordinates in the bottom status bar. Shift+ Left Click also changes the center of rotation or zoom for Camera View or Zoom.

You can query mouse coordinates in 2D graphics as well.

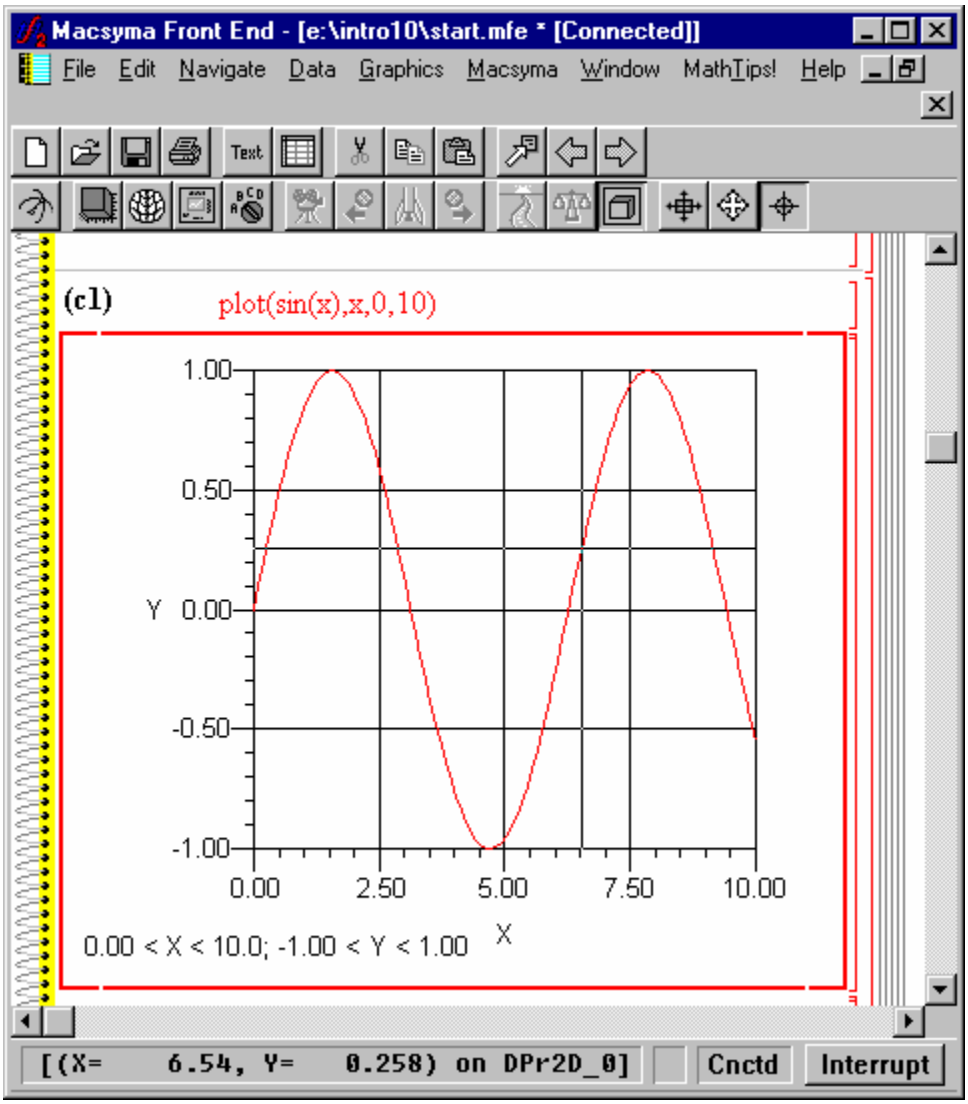


Figure 40b Sine Curve with 2D Mouse Coordinates

Cursor Attributes	Description
Color	Sets the cursor line color. (Default: Black)
Enable	Enables cursors for this object. (Default: On)
Line Style	Sets the cursor line style. Currently one of the standard Windows line styles. (Default: Solid)
Line Width	Sets the cursor line width. See also the Graphics attribute *Faces: 3D Cursor Always Crosses under Face.* (Default: 0)

7.4.3.11. Points Attributes

Points attributes control the placement of symbols on the plot points in graphics.

Points Attributes	Description
Character Number	Determines number of character to use for point symbol if Points: Type is set to Character Symbols. The character is taken from the font specified by Points: Symbol Font (page 89).
Enable	Displays points in 2D graphics. Otherwise, only line elements are displayed. (Default: Off)
In Color	Uses the prevailing color model to color point symbols. Otherwise, the color setting currently assigned in Symbol Font is used. (Default: Off)
Size	Sets pixel size of non-character symbols such as filled squares. See *Type*. Character symbols are sized according to the selected Symbol Font. (Default: 0)
Skip Count	Sets skip interval for drawing point symbols. Useful when data points are placed so close together that their symbols overlap. A skip count of 5, for example, will cause only every sixth point to be drawn. (Default: 0)
Start Offset	Determines how many points are skipped before the first point on the left is drawn when the Points: Skip Count is greater than 1. If you set this to -1, Macsyma will pick a start offset that positions the drawn points as symmetrically as possible in the graph. (Default: 0)
Symbol Font	Sets font for graph point symbols. Applicable only when Points: Type is set to Character Symbols. (Default: Wingdings Regular 11)
Type	Type of point symbol to use: (Default: Character Symbols)) ■ *Character Symbols:* Use the character number set in Points: Character Number from the font selected in Points: Symbol Font. ■ *Filled Squares:* Use a filled square. The boundary is always black. The fill color is determined by the attribute Points: In Color. ■ *Filled Triangles:* Use a filled triangle. Color is the same as for filled squares. ■ *Filled Circles:* Use a filled circle. Color is the same as for filled squares.
Use Assigned Symbol	Assigns a default character number to each point. Takes precedence over the selection in Points: Character Number and forces the Points: Type to be Character Symbol. (Default: Off)

7.4.3.12. Surface Attributes

Surface attributes control surface properties in graphics.

Surface Attributes	Description
Back Face Color	Determines color for back faces when Surface: Back Face Constant Color is On. (Default: Black)
Back Face Constant Color	Renders back faces with a constant color. When Off, the prevailing color model is used. (Default: Off)

Surface Attributes	Description

Front Face Color	Determines color for front faces when Surface: Front Face Constant Color is on. (Default: Black)
Front Face Constant Color	Renders front faces with a constant color. When Off, the prevailing color model is used. (Default: Off)
Light Back Face	Applies lighting calculations to back faces. Lighting calculations are always applied to front faces. (Default: On)
Show Back Face	Displays backfacing. (Default: On)
Swap Front and Back Faces	Swaps attribute settings between front and back faces, including color settings and transparency. (Default: Off)
Vertices Per Surface	Controls when whether triangular or quadrangular surface elements are generated. You can set this attribute to either 3 or 4 for 3D "array type" data (as from Element plot3D. Values other than 3 or 4 generate quadrangles. This setting is ignored for "mesh type" graphics such as those generated by PLOTSURF. (Default: 4)

7.4.3.13. Wireframe Attributes

Wireframe attributes control the mesh lines drawn on polygonal edges in three-dimensional graphics. They control the appearance of the lines along the edges of the polygons from which two-dimensional surfaces are constructed in Macsyma and MFE graphics.

Wireframe Attributes	Description
Color	Sets color for wireframe (mesh polygon boundary). (Default: Black)
Color Like Face	Makes wireframe color same as face color. (Default: Off)
Width (Display)	Controls width of wireframe (mesh polygon boundary). (Default: 1)
Intensity Multiplier	Determines the wireframe color intensity when Wireframe: Color Like Face and Wireframe: Use IHS Multipliers are both On. (Default 0.75)
Hue Multiplier	Determines the wireframe color hue when Wireframe: Color Like Face and Wireframe: Use IHS Multipliers are both On. (Default: 1)
Saturation Multiplier	Determines the wireframe color saturation when Wireframe: Color Like Face and Wireframe: Use IHS Multipliers are both On. (Default: 1)
Use IHS Multipliers	Applies the Wireframe: Intensity, Saturation, and Hue multipliers to the face color (Default: On)

7.4.3.14. Vector Attributes

The vector attributes affect the appearance of vectors in PDEase and Macsyma vector plots.

Vector Attributes	Description
Head Symbol	Symbol to display for vector heads. (Default Two Ticks Inwards)
Tail Symbol	Symbol to display for vector tails. (Default None)

Head Size	Size of vector head symbol. (Default 2)
Tail Size	Size of vector tail symbol. (Default 2)

7.4.3.15. Clip Attributes

Clip Attributes	Description
Camera Clipping Box	Specifies the camera's clipping box in camera space. You can also use the clipping slider in the Camera View dialog. The values in this box are now normalized (i.e., they should range between 0.0 and 1.0). A value of 0.0 means the associated plane is not clipping at all, a value of 0.5 means it is clipping half-way along its direction of travel, and a value of 1.0 means it is fully clipping.
Clip Children	Reserved for future use.
Clip Self	Reserved for future use.

7.5. DataViewer Attributes

DataViewer attributes control the appearance and behavior of DataViewer sections in notebooks. To edit these attributes:

- In the currently selected DataViewer section, click *Edit-Section Properties* and select category DataViewer.
- In the current notebook, click *File-Options* and select the category DataViewer.
- Click *File-Option Defaults* and select the category DataViewer to apply by default to all future notebooks,.

The *Edit Section Properties* Dialog for the DataViewer category looks like:

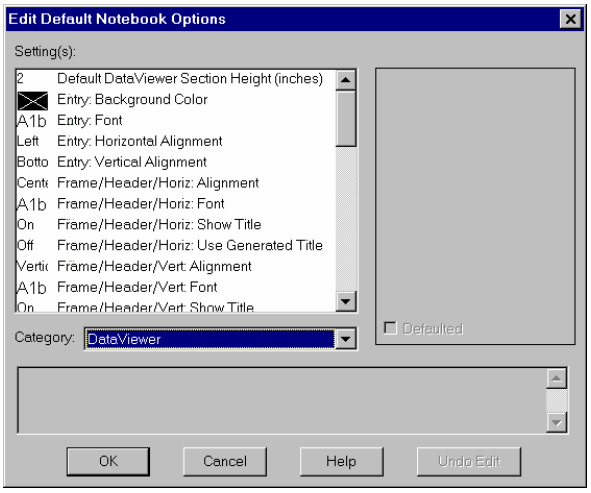


Figure 41 DataViewer Options Dialog

DataViewer Attributes	Description
Default DataViewer Section Height	(Default: 2)
Entry: Background Color	(Default: Transparent)
Entry: Font	(Default: Arial 10)
Entry: Horizontal Alignment	(Default: Left))
Entry: Vertical Alignment	(Default: Bottom)
Frame/Header/Horiz: Alignment	(Default: Centered)
Frame/Header/Horiz: Font	(Default: Arial 10)
Frame/Header/Horiz: Show Title	(Default: On) (Default On)
Frame/Header/Horiz: Use Generated Title	(Default: On)
Frame/Header/Vert: Alignment	(Default: Vertical centered)
Frame/Header/Vert: Font	(Default: Arial 10)
Frame/Header/Vert: Show Title	(Default: On)
Frame/Header/Vert: Use Generated Title	(Default: On)
Frame: Border Style	(Default:)
Frame: Default Cell Height	(Default: 18)
Frame: Default Cell Width	(Default: 48)

DataViewer Attributes	Description
Frame: Grid Line Bkg Color	(Default: Transparent)
Frame: Grid Line Color	(Default: Gray)
Frame: Column Vectors	Controls the default orientation for vectors added to new DataViewers, such as those you can create with Data-View (Default: On).
Frame: Grid Line Type	(Default: Thin line)
Frame: Head Grid Line Bkg Color	(Default: Transparent)
Frame: Head Grid Line Color	(Default: Black)
Frame: Head Grid Line Type	(Default: 3D)
Frame: Header Border Style	(Default:)
Frame: Layout	(Default: Standard layout)

Frame: Root Cell Height (Default: 24)

Frame: Root Cell Width (Default: 56)

Frame: Scroller Border Style (Default:)

Frame: Scroller Pivot Border Style (Default:)

Frame: Scroller Thickness (Default: 12)

Frame: Show Title (Default: On)

Frame: Sizer Border Style (Default:)

Frame: Sizer Line Bkg Color (Default: Transparent)

Frame: Sizer Line Color (Default: Black)

Frame: Sizer Line Type (Default: Thick line)

Frame: Sizer Pivot Border Style (Default:)

Frame: Sizer Thickness (Default: 9)

Frame: Title Alignment (Default: Left)

Frame: Title Font (Default: Arial 10)

Frame: Values Border Style (Default: 0)

7.6. Print Attributes

Print attributes control the appearance of a printed notebook. To edit the appearance of printed output:

- From the current notebook, click *File-Options* and select the category Printing.
- From all future notebooks, click *File-Option Defaults* and select the category Printing.

The Edit Default Notebook Options Dialog looks like:

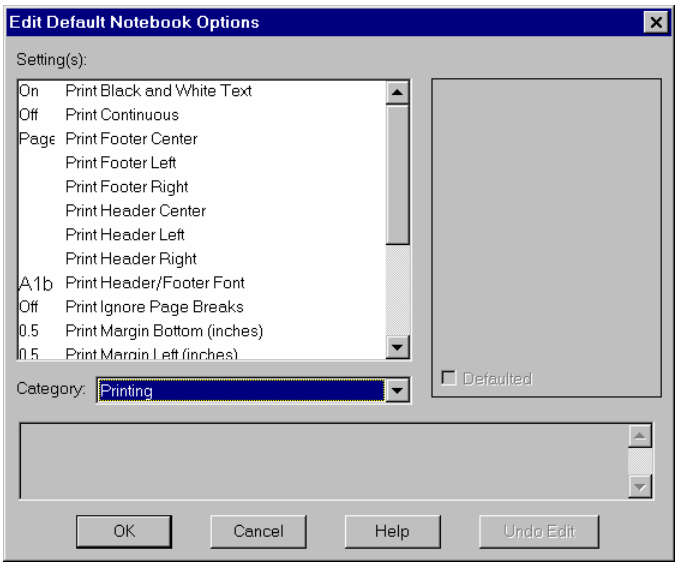


Figure 42 Print Options Dialog

Print Attributes	Description
Black and White Text	Prints all text as black and white, regardless of the font color settings. This feature prevents stippling when printing color text on black and white printers. When Off, text font colors are sent to the printer. This attribute affects Text, Math Input, and Math Output sections. (Default: On)
Margin Left (inches)	Sets width of the left margin on the printed page. It does not affect screen display. (Default: 0.5)
Margin Top (inches)	Sets height of the top margin on the printed page. It does not affect screen display. (Default: 0.5)
Margin Right (inches)	Sets width of the right margin on the printed page. It does not affect screen display. (Default: 0.5)
Margin Bottom (inches)	Sets height of the bottom margin on the printed page. It does not affect screen display. (Default: 0.5)
Header Left	Determines what text prints at the top left of each page. See also *Header/Footer Font.* Print headers and footers are a mixture of simple text and variables. Header and footer symbols are preceded by an ampersand. Case does not matter. Can be one of the following (Default: “”):

Symbol	Action
ampersand	Print an ampersand
d	Print the date
f	Print the filename
p	Print the page number
t	Print the time
w	Print the day of the week

Header Center	Prints header text at the top center of each page. See also *Header/Footer Font.* (Default: "")
Header Right	Prints header text at the top right of each page. See also *Header/Footer Font.* (Default: "")
Footer Left	Prints footer text at the bottom left of each page. See also *Header/Footer Font.* (Default: "")
Footer Center	Prints footer text at the bottom center of each page. See also *Header/Footer Font*. (Default: "")
Footer Right	Prints footer text at the bottom right of each page. See also *Header/Footer Font*. (Default: "")
Header/Footer Font	Determines font used to print the headers and footers. (Default: Arial 7)
Scale	Determines the degree of scaling when the notebook is printed. With the default settings of 7.5 inches for the notebook width, and 1/2 inch for the left and right margins, a setting of 0.9 allows a notebook to fit in a typical 8 1/2 inch HP LaserJet printer page width. (Default: 0.9)
Continuous	Controls splitting of sections across pages. When Off, a section is never split across a page unless it is longer than a page. When On, sections split across pages wherever page breaks fall. (Default: Off)
Ignore Page Breaks	Allows explicitly set page breaks to be ignored. Can be used to produce more compact output for draft purposes. See *Edit-Page Break After*, to specify page breaks in a notebook. (Default: Off)
Section Brackets	Controls whether section brackets are printed. (Default: Off)
Section Separator Color	Controls printing color of section separator brackets. (Default: Transparent)
Notebook Borders	Controls the printing of notebook borders. Note that spiral borders do not print on most printers. (Default: Off)

Chapter 8.
The MFE Math Engine

8.1. In This Chapter

8.2. About the MFE Math Engine

- *8.3. Entering Data into MFE Math Engine from Macsyma*
- *8.4. The mfe_data Package*
- *8.5. Naming Conventions for MFE Variables*

8.2. About the MFE Math Engine

MFE calculates, stores, graphs and views data associated with a notebook. The MFE math engine that manages and computes with this data is separate and distinct from both the PDEase and Macsyma math engines. Each MFE notebook has its own set of data and names for referencing the data. PDEase uses MFE variables to capture and graph its output. Macsyma can access MFE variables and use the MFE math engine to access external numerical libraries.

8.3. Entering Data into MFE Math Engine from Macsyma

This section describes the basic commands for transferring data from the Macsyma math engine to the MFE math engine and MFE variables/

mfe_put*(mac_var, mfe_var)* *Function*

Places Macsyma data into an MFE array.

Variable	Results
mac_var	Result.
scalar	Assigns scalar value to *mfe_var*.
list	Creates 1D MFE array.
matrix	Creates 2D MFE array.
array	Creates corresponding MFE array.
string	Creates 1D MFE array of characters.

Macsyma variables must be integers, floating point numbers, or Macsyma strings. They cannot be big floats, big integers, complex numbers, rational numbers, block matrices, or any other Macsyma object that does not evaluate to a number or string.

mfe_get*(mfe_var, mac_var)* *Function*

Places data from the MFE *mfe_var* into the Macsyma environment. You can supply the optional argument *mac_name* only when getting an MFE array.

mfe_var	mac_name	Result
MFE scalar	(ignored)	Returns a scalar.
1D MFE array	not given	Returns a list filled with values from MFE.
2D MFE array	not given	Returns a matrix filled with values from MFE.
2D MFE array	not given	Returns nested list structure.
MFE array	given	Fills array macs_name with data from *mfe_var* and returns the array name *mac_name*.

mfe_eval*(command_string {,value_flag, mac_name})* *Function*

Evaluates *command_string* in MFE. If *value_flag* = **true**, the result of the evaluated MFE command is returned as in **mfe_get**. If *value_flag* = **false**, no result of the MFE command is returned to Macsyma, and **mfe_eval** returns Done.

view_mfe_data*(mfe_name0 {, mfe_name1, ..})* *Function*

The MFE object with name *mfe_name0* appears in a DataViewer section in the current notebook. *mfe_namei* can refer to either a 1D or 2D array in the MFE environment. **View_mfe_data** attempts to provide the most suitable display of the data, depending on the dimension of the MFE arrays.

By default, the DataViewer uses double precision for floating point numbers in MFE math variables. If the *mfe_namei* is single precision, the DataViewer uses *e*-format to display it. You can enter single precision values using *e*-format. The MFE math engine will convert the number type as needed.

The DataViewer displays MFE variables or math expressions. You must move Macsyma math engine data into an MFE variable before you can view it. Similarly, you must import data from a file into an MFE variable to view it.

If you try to create a DataViewer section, you may be prompted for the name of an MFE variable to view. You can create an empty DataViewer section by clicking *Edit-Insert Section* and selecting DataViewer.

If no MFE variables exist, you must create one by:

- Using the **mfe_put** command (page 97) to create an MFE variable from a Macsyma math engine variable.
- Importing data from a file. Use *Data-Import* to select the file and name the MFE variable (page31).
- Assigning the data from an existing graphics section. Use *Graphics-Assign Data to Variable* (page 41).

plot_mfe_data*(mfe_name0 {,mfe_name1, ..})* *Function*

The MFE object with name *mfe_name0* appears in a graph in the current notebook. *mfe_namei* can refer to either a 1D or 2D array in the MFE environment. **plot_mfe_data** plots all MFE arrays in one plot, regardless of their dimensions.

mfe_update_now*()* *Function*

Updates the math objects before the Macsyma computation.

mfe_kill*()* *Function*

Removes the MFE object *mfe_name* from the MFE environment.

8.3.1. Import and Export — External Data Files

You can export an MFE variable to a file by clicking *Edit-Export*. You can choose CSV or fixed field format. Similarly, you can import an external data field in CSV or fixed fields format by clicking *Edit-Import* (page 31).

8.4. The mfe_data Package

These commands are preliminary and are subject to change without notice. Refer to the online documentation.

- See usage(mfe_data);
- Do demo(mfe_data); for several examples.

8.4.1. Getting Data From the MFE Math Engine

get_data_line(*objname, r_or_c, numb*) *Function*

Returns a Macsyma list whose values are taken from column (or row) number *numb* from the Macsyma matrix, Macsyma array, or MFE array named *objname*. *r_or_c* must be either 'row or 'col.

get_data_line_as_matrix(*objname, r_or_c, numb*) *Function*

Returns a Macsyma matrix whose values are taken from column (or row) number *numb* from the Macsyma matrix, Macsyma array, or MFE array named *objname*. *r_or_c* must be either 'row or 'col. This returns a column or row vector.

get_data_as_matrix(*objname*) *Function*

Returns a Macsyma matrix whose values are taken from the Macsyma matrix, Macsyma array, or MFE array named *objname*.

get_data_as_array(*objname, arrname*) *Function*

Fills the Macsyma array named *arrname* with the contents of the Macsyma matrix, Macsyma array, or MFE array named *objname*. Returns the name *arrname*.

zero_based_arrays *default:* **false** *Option Variable*

For commands in the **mfe_data** package, *zero_based_arrays* determines whether (Macsyma and MFE) arrays are referenced with zero-based indexing or 1-based indexing. Matrices are always 1-based.

Zero_based_arrays	Index first row/col of array
false	1
true	0

8.4.2. Putting Data in the MFE Math Engine from Macsyma

new_data_object*(mfe_name {,numtype, dim1, dim2})* *Function*

Creates a new MFE object of type args =[type,num1,num2] and displays it in a DataViewer. If no number type or size is given, the default is a double float 10 x 10 array.

put_data_cell*(data, objname {,colnum})* *Function*

Changes the value of one cell in a 1D or 2D Macsyma matrix or Macsyma array or MFE array.

put_data_1d*(dataobj, mfe_name, r_or_c , indexnum)* *Function*

Puts 1D data into a 1D or 2D MFE array with name mfe_name. *Mfe_name* must be the name of an existing MFE array. The value of *r_or_c* must be either 'row or 'col, and its value determines the acceptable forms of the 1D data object *dataobj*.

Value of *r_or_c*	Acceptable forms of *dataobj*
row	Macsyma list or row vector.
col	Macsyma list or matrix.

8.4.3. Viewing MFE Data

This section describes how to produce two- and three-dimensional plots in Macsyma from MFE variables. The *Macsyma Graphical Users' Interface Guide* describes how to produce plots from Macsyma variables. Please refer to the *Macsyma Graphical Users' Interface Guide* for more detailed information about plot options.

8.4.3.1. Making Two- and Three-Dimensional Plots of MFE Data

graph2d_data*(objname, r_or_c, col1{,col2})* *Function*

Graphs column (or row) *col1* of data object *objname* on the horizontal axis and columns (or rows) *col2,..* of *objname* on the vertical axis. *objname* must be a Macsyma matrix, a Macsyma array, or an MFE array. *r_or_c*, which must be either 'row or 'col, determines whether rows or columns are extracted from *objname*.

If *objname* is a one-dimensional matrix, Macsyma array or MFE array, then the values are plotted as a function of the integer array index. See **plot_mfe_data**, page 109.

graph3d_data*(objname, r_or_c, col1, col2, col3 {,plotcode})* *Function*

Makes a scatter plot of the columns (or rows) *col1*, *col2*, *col3* of the MFE array *mfe_name*. *r_or_c* must be either row or col and determines whether rows or columns are extracted from *mfe_name*. The optional argument *plotcode* is a list of integers that control the line type and plot point symbol. If *plotcode* is unspecified, **graph3d_data** produces a scatter plot with no lines connecting the plot points.

plot3d_data*(objname {,whereplot, mfe_name})* *Function*

Plots the values in the Macsyma matrix, Macsyma 2D array, or 2D MFE array *objname* against the integer indices on the two horizontal axes. If the optional argument *whereplot* has the value "macs", the plot is generated in Macsyma. If *whereplot* has the value "mfe", then *mfe_name* must be specified, the plot is generated in MFE, and the values in *objname* are stored in the MFE array *mfe_name*.

contourplot_data*(objname)* Function

Draws a contour plot of the matrix, Macsyma array, or MFE array.

8.4.3.2. Smoothing and Graphing MFE Data

graph_smoothed_data*(objname, r_or_c, col1, col2{,type})* *Function*

Fits the data in column (or row) *col2* of the matrix, Macsyma array, or MFE array *objname* to the abscissas in column (row) *col1* with a cubic spline (default), rational function, or polynomial. *r_or_c*, which must have one of the values row or col, determines whether rows or columns of *objname* are graphed. If the value of the optional argument *type* is specified, it must have one of the values: poly rat, spline. The value of *type* determines the type of smoothing.

8.5. Naming Conventions for MFE Variables

8.5.1. About Naming Conventions

PDEase uses MFE variables for every specified monitor and plot and to store data and settings for **Graphics** and **DataViewer** sections. PDEase associates only one data set with a single MFE variable and uses a hierarchical naming scheme to generate unique names.

Similarly, Macsyma uses MFE variables for **DataViewer** and **Graphics** sections. You can assign graphics data to MFE as well Macsyma variables. Use *Graphics-Assign Data to Variable*.

PDEase and Macsyma attach other information (such as attribute settings) to the variables. Future versions of MFE will give you programmatic access to this information. For now, you should consult the *PDEase2D Reference Manual* and any *Release Notes* for information about using PDEase generated MFE variables. The *PDEase2D Reference Manual* also describes the detailed data organization of these variables.

The rest of this section briefly describes the naming conventions of MFE variables. You can find more information about the data structure of the MFE variables that PDEase uses in the *PDEase2D Reference Material*.

For example, after running a sample PDEase problem, Data-View shows MFE variables that look like:

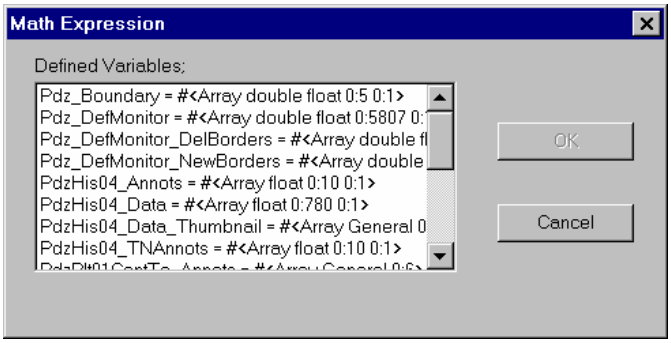


Figure 43 Sample Data View dialog

In this example, all the MFE variables generated by PDEase have names that begin with the default root name "Pdz".

8.5.2. Variable Names

Variable names consist of a base part plus one or more appended modifiers. The base part is composed of up to four fields:

<base>® <root><class><dd><type>

<root> The root field is a sequence of letters or digits starting with a letter). You can specify the root name in the MFE_Switches section of the input script. For instance you might specify "Axiheat" as the root name for the Axiheat.mfe sample file. PDEase will use the root names "Pdz", "Pdz0", "Pdz1", etc. by default if you have not specified a name.

<class>→ {Mon | Plt | His}

This field indicates that the information in this variable is associated with a Monitor, Plot, or History, respectively.<dd>→ {two or more decimal digits}

PDEase maintains a single count (starting at 01) of all monitors, plots, and histories in a given script and assigns each a successive number based on the order in which they. Gaps in the number sequence do *not* indicate loss of data.

<type>→ {Grid | Vect | Cont | Surf | Elev | ∅}

The type field indicates the plot type for monitors and plots. It is omitted for histories.

PDEase includes the associated base variable name in the caption of all plots it creates by default.

PDEase appends one or more modifiers to the base name to indicate: content of the variable, whether it is formatted for display in a DataViewer, and whether it is static data, an animated/stacked data set, or part of an iterated set of data. See the *PDEase2D Reference Manual* for more information.

8.5.3. Static Variable Names

Static variable name syntax is used for all monitor and plot variables in simple steady-state problems. History variables always exhibit the second form shown below:

<base><cont>

or

<base><ddd><cont>

<ddd> → {three or more decimal digits}

For elevations and histories, variables containing data for each curve are numbered sequentially.

<cont> → {_TNLines | _TNAnnots | _Data | _Annots}

_TNLines: Contains boundary line information for the thumbnail. (Applies only to variables with associated thumbnails, such as elevations and histories).

_TNAnnots: Describes the thumbnail's annotation letters.

_Data: Contains information for generating a graphic's plot data display.

_Annots Contains information used to draw annotation letters associated with a graphic (elevations, histories, and contours use annotation variables surface and vector plots do not).

8.5.4. Animate/Stacked Variable Names

Variables associated with Animated/Stacked graphics are either stacked or unstacked. Monitors and all plots in time dependent, eigenvalue, or staged problems are "stackable." Histories are never stackable. See the *PDEase2D Reference Manual* for more information.

<base><anim><cont>

or

<base><ddd><anim><cont>

[anim] → {Ma | Ta | Sa}

Ma designates an eigenvalue run variable.

Ta designates a time dependent run variable.

Sa designates a staged run variable.

These never appear with history variables.

8.5.5. Noanimate/Spread Variable Names

The name syntax for Noanimate/Spread graphic variables is essentially the same as for animated variables, except that the final 'a' is replaced by an iteration count. Only plots can be spread. See the *PDEase2D Reference Manual* for information about Noanimate or spread variables.

<base><iter><cont>

or

<base><ddd><iter><cont>

<iter> → {M | T | A}<dd>

M designates an eigenvalue run variable.

T designates a time dependent run variable.

S designates a staged run variable.

These never appear with history variables.

<dd> → {two or more decimal digits}

PDEase maintains a separate iteration count for each time dependent, staged, or "eigenmode run" monitor or plot. The count is appended here. If you animate such a plot instead of spreading it, this number corresponds to the animation frame number.

8.5.6. DataViewer Variable Names

See page 8 for more information about DataViewers.

DataViewer names take the form:

<base><ddd>Dv<iter>

<ddd> → {three or more decimal digits}

DataViewer variables associated with elevations or histories use this curve number. It does not appear with surface or contour-associated DataViewer variables.

<iter>→ Same interpretation as for graphic variables.

8.5.7. Special Variable Names

The <root> associated with every PDEase command section appears as an integer-valued variable in PDEase and MFE data dialogs. Do not alter or delete it.

<root>_Boundary

Variables with this name are automatically assigned to all executed scripts. They contain boundary information.

<root>_DefMonitor, <root>_DelBorders, and <root>_NewBorders

These types of variables appear for all executed scripts which do not contain the NODEFAULTMONITOR=TRUE selector. They contain data for displaying the default problem grid monitor, edges deleted during refinement/iteration (if any), and edges added during refinement/iteration (if any), respectively.

<base>Dv<iter>_Index

Variable names with this syntax appear for all DataViewers associated with elevations or histories. They contain the domain values for the elevation/history range calculations.

Most of the time you will specify the graphics and DataViewers you want in the Monitors, Plots, and Histories sections of PDEase scripts and execute them. MFE then creates the graphic and DataViewer sections automatically. However, the new MFE variables appear in several dialogs, so you need to understand their data organization before you use them. See the *PDEase2D Reference Manual* for more information.

8.5.8. Graphics Object Names

Graphic object names appear in the Graphics Attribute Editor dialog's Objects list box. MFE uses specific naming conventions:

A camera object called either Camera2D or Camera3D appears at the top of the object hierarchy. Camera2D's are always associated with 2D graphics. Camera3D's are usually associated with 3D graphics but sometimes appear for 2D graphics as well.

Below the camera is **a bounding box** called DBB2D or DBB3D.

Next come **Axis and Face objects.** Their names suggesting which axis or face position they control. (You may assign names or us the default axis names.)

Finally, you will see a list of one or more **display presenters** associated with the graphic data. Macsyma-

generated presenters will have names of the form DPr2D_x for 2D data or DPr3D_x for 3D data where x is an integer starting at 0. When multiple presenters appear in the same graphic, they will be consecutively numbered in x.

When an MFE variable is added to a graphic, the variable name appears instead of DPr2D_x or DPr3D_x.

Files saved with previous versions of MFE may name objects differently.

INDEX

B

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

X

Y

Z