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AMOPS: computer program for the calculation of area and moments of area of planar shapes

Associated software: VIEWpac AMOPS

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The Mechanisms Committee, which first met in 1975, is continuing the work that previously was the responsibility of the former Gearing and Mechanisms Committee, which first met in November 1964. Like the earlier Committee it has the cooperation of many engineers and scientists in industry, research establishments and universities from whom much assistance and information is being received.

ESDU AMOPS: COMPUTER PROGRAM FOR THE CALCULATION OF AREA AND MOMENTS OF AREA OF PLANAR SHAPES

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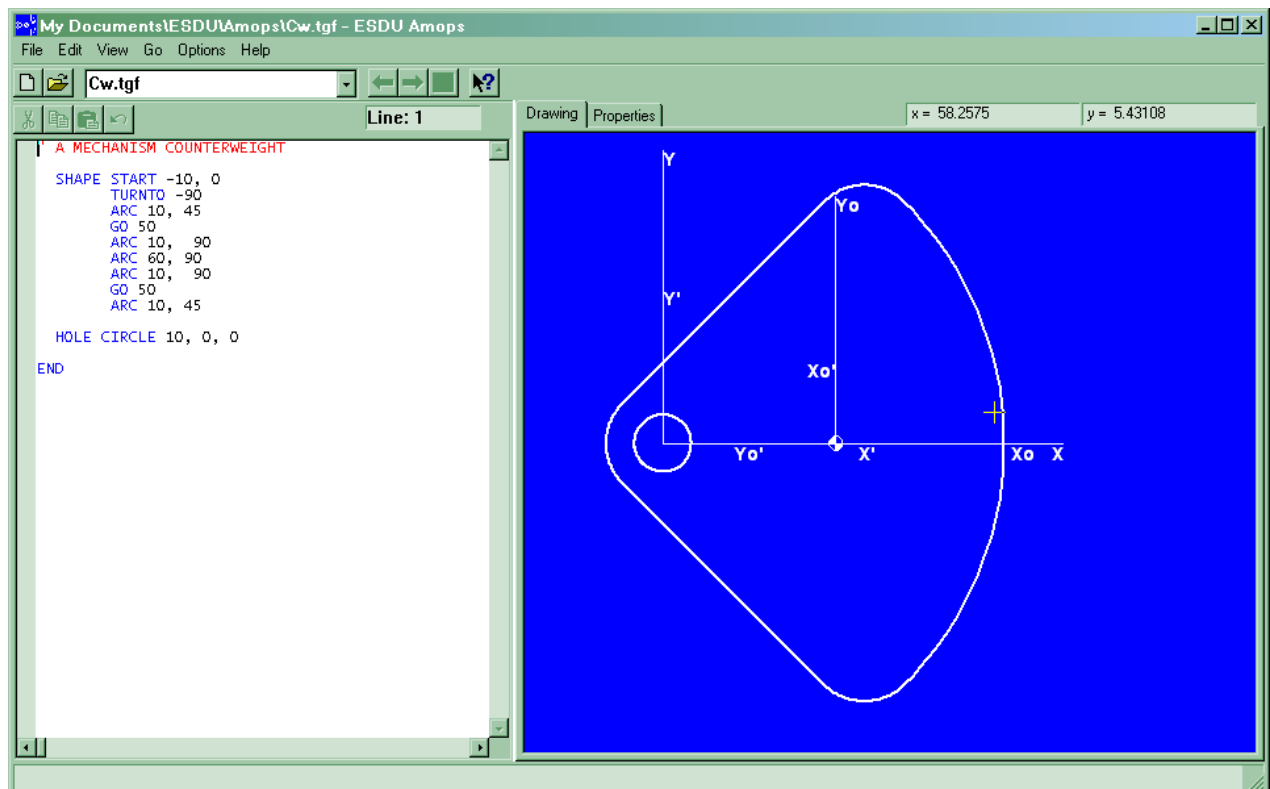
ESDU AMOPS: COMPUTER PROGRAM FOR THE CALCULATION OF AREA AND MOMENTS OF AREA OF PLANAR SHAPES

1. OVERVIEW OF ESDU AMOPS

ESDU Amops is a program for calculating the area and moments of area of planar shapes. The program determines the total area of the shape, the position of the centre of area, first and second moments of area, product moments of area, principal axes, principal moments, and radii of gyration. Guidance is provided on the interpretation of these properties and on the calculation of related properties, such as mass moments of inertia.

Shapes are defined by a series of graphics commands entered in an integrated editing pane. Amops includes sample shape files, which can be studied or used as a basis for defining other shapes.

A drawing of the defined shape or a list of the computed properties of the shape is displayed in a results pane. The drawing and properties can be printed or saved to a file in a variety of formats including metafiles, bitmaps, hypertext markup language (HTML), scalable vector graphics (SVG), drawing interchange file (DXF), as well as plain text. Likewise, a complete report of the analysis, which includes the drawing and properties, can be printed or saved as a web page.



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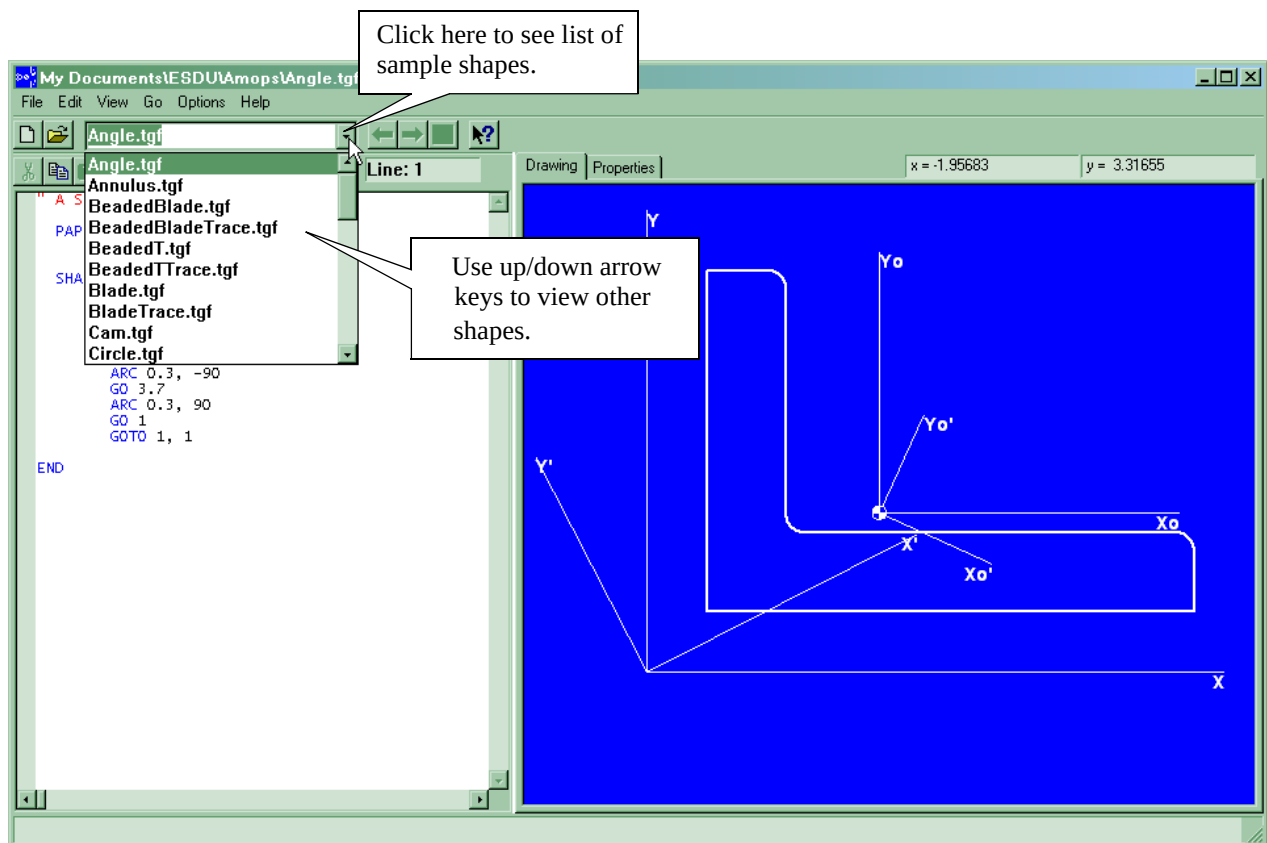
2. USING ESDU AMOPS

This section provides a brief description of the essential steps in using Amops to enter and edit graphics commands, view the drawing of the defined shape and the results of the analysis, print and save the work, and create reports.

2.1 Starting Amops

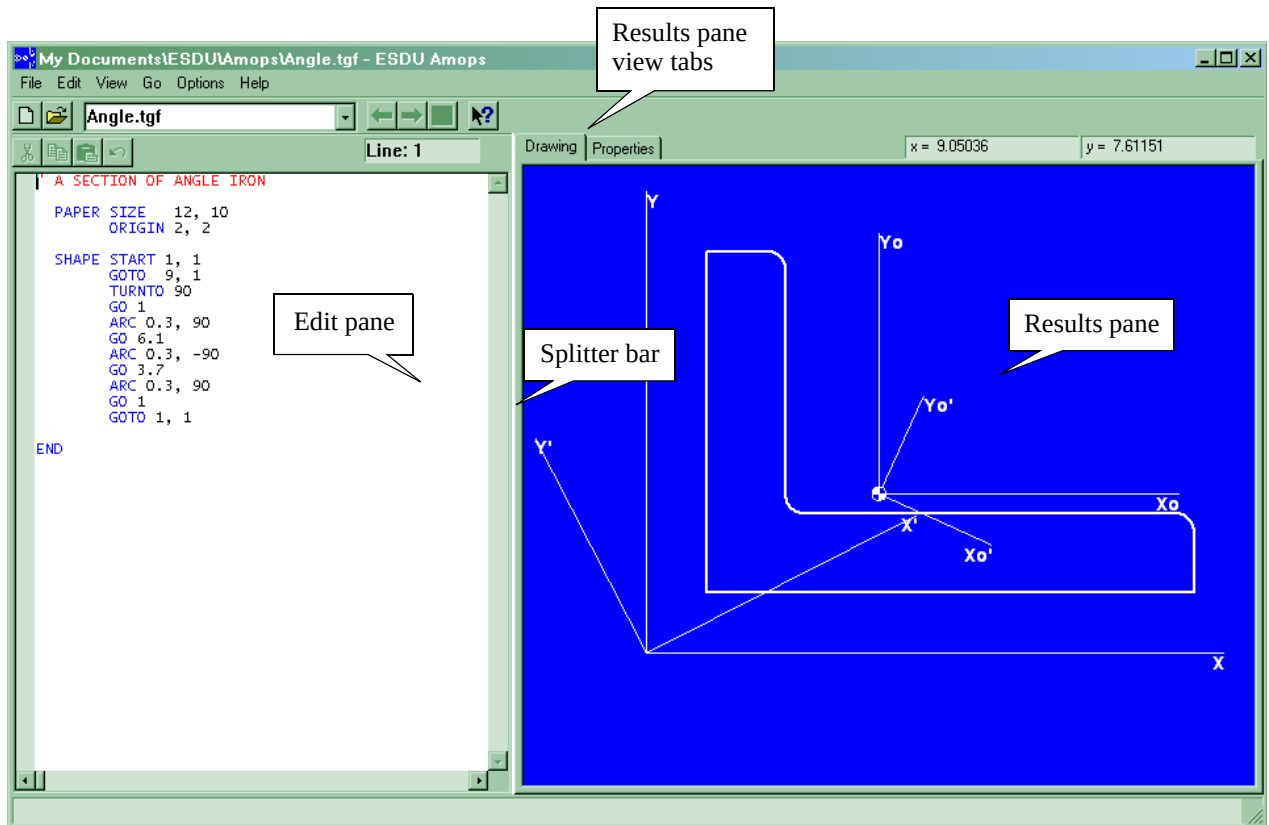
To start Amops from Windows Explorer, locate the executable file, "Amops.exe", and double click it with the left mouse button. The Amops window will appear. If required, enlarge the window by clicking the Maximise button in the upper right hand corner of the window or by double clicking on the title bar at the top of the window.

Amops comes with a number of sample shape files and when it is run for the first time, it places copies of these sample files in a default working directory[†] and then displays one of these copies. The other copied samples can be viewed by first clicking on the Files combo box button on the toolbar to reveal a list of the names of all of the sample files. The keyboard up and down arrow keys can then be used to move the highlight up and down in the list and change the displayed drawing accordingly. The user is free to use and edit any of these sample files for their own analysis.



[†] Depending on the computer system configuration, the default directory chosen by Amops is typically "My Documents\ESDU\Amops".

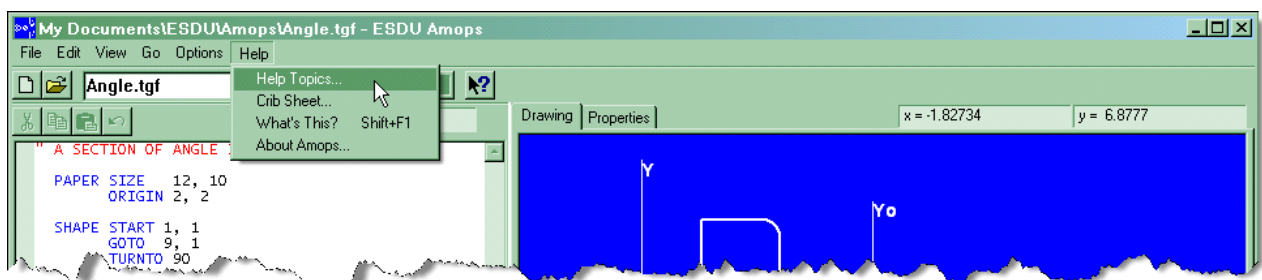
Amops has two main panes, an Edit pane on the left and a Results pane on the right. If required, the relative sizes of these two panes can be adjusted by dragging the splitter bar located between the two panes. This is done by moving the mouse cursor over the splitter bar until the cursor shape changes, pressing and holding down the left mouse button and dragging the splitter bar to the required position and releasing the mouse button.



The Edit pane displays the graphics commands defining the shape to be analysed and the Results pane displays either a drawing of the defined shape or the computed properties of the shape. The Results pane view can be changed by clicking one of the tabs labelled "Drawing" and "Properties" at the top left hand corner of the Results pane.

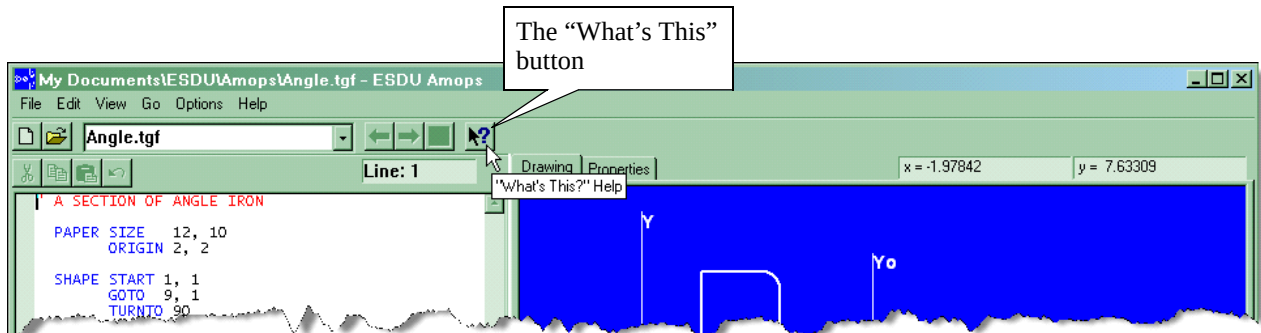
2.2 Getting Help

Amops provides extensive help documentation and context sensitive help. The help documentation can be accessed by selecting "Help Topics" from the application "Help" menu.



Note that the help documentation includes many step-by-step guides to certain procedures in Amops. These procedure guides are displayed in a separate window that, for convenience, remains visible while Amops is being used.

Context help can be accessed from the F1 function key, from the “Help” menu, or from the “What’s This” button on the toolbar.



Context help provides information on the various components of Amops and on menu items. To get context help on a window or control, click the “What’s This” button. The mouse cursor will change to a question mark, which can then be clicked on the item of interest. A small window will appear with text explaining the purpose of the item.

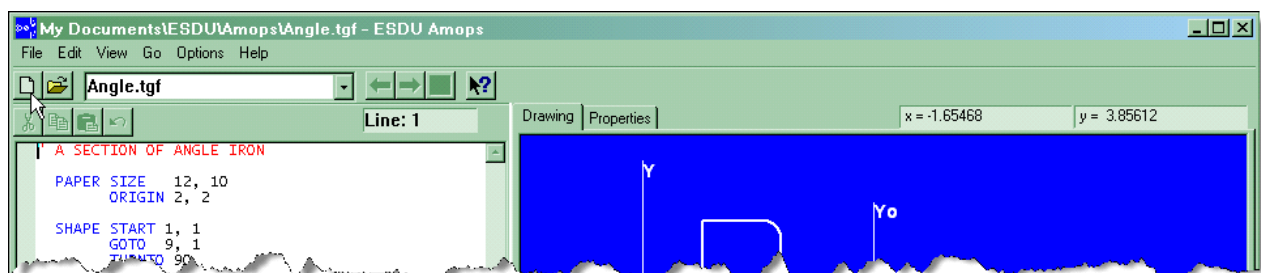
To get context help on a menu item, move the menu highlight to the item of interest and then press the F1 function key. Again, a small window of information text will appear. Note that the purpose of the highlighted menu item is always displayed in the status bar at the bottom of the Amops main window. F1 context help provides an expanded explanation where appropriate.

Context help can also be obtained on individual graphics command keywords and on any error message that might have been issued. This type of context help is explained in later sections.

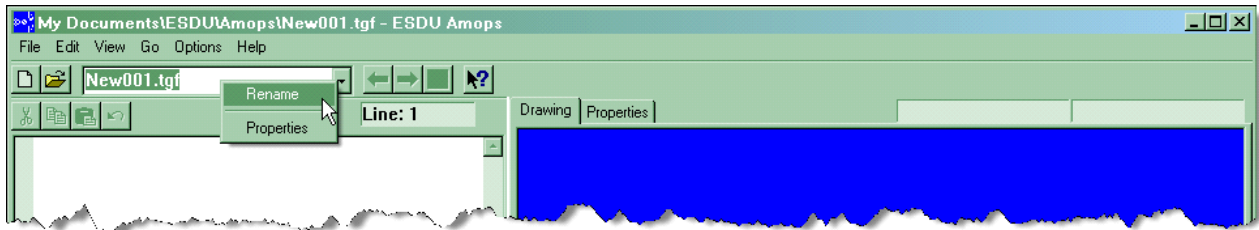
2.3 Starting a New Shape

A new shape can be started in one of two ways. It can be based on a previously defined shape or it can be defined from scratch.

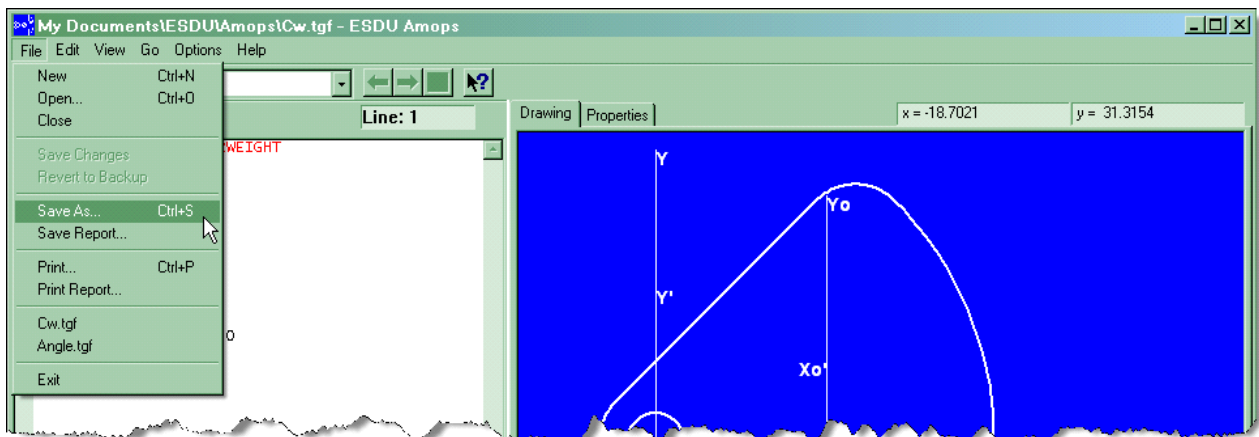
A new, blank, shape can be started simply by clicking the “New” button on the toolbar.



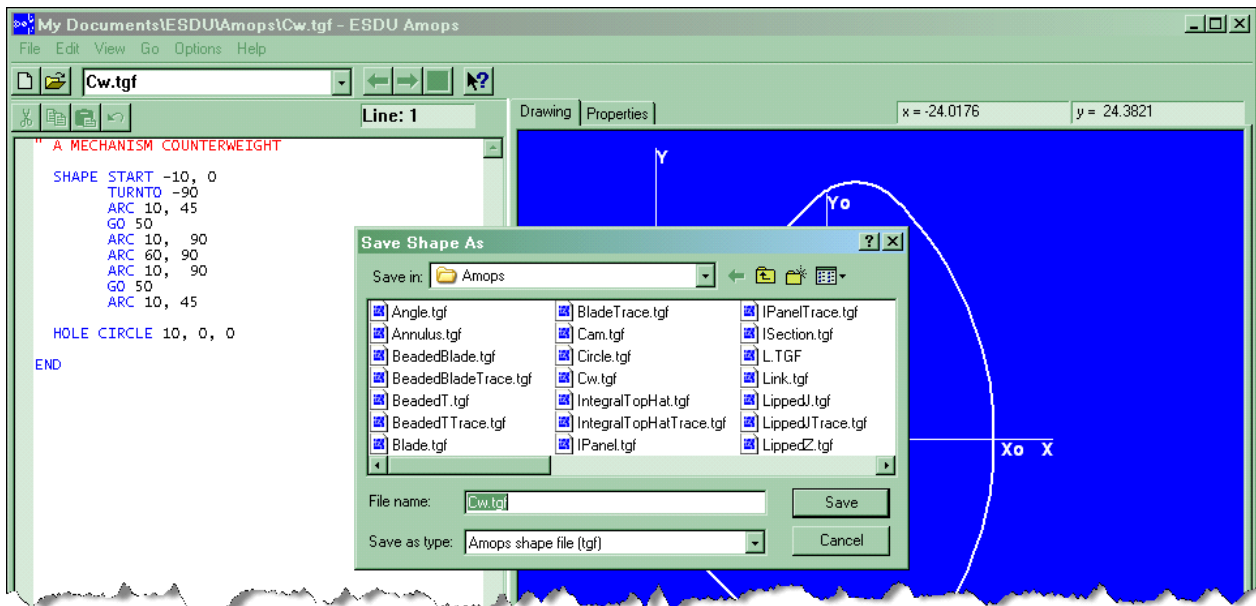
New shapes created in this way are given a default name, such as “New001.tgf”. The name of the newly created shape file appears in the Files combo box edit field on the toolbar. If required, the name can be edited *in situ* to something more meaningful by first clicking the right mouse button on the Files combo box edit field. A small context menu will appear with two options, “Rename” and “Properties”. Select “Rename” and then edit the name directly in the edit field. Press the Enter key when finished to confirm the change of name.



If a new shape is to be based on a previously defined shape, it is first necessary to ensure that the shape on which the new shape is to be based is being viewed. Other shapes can be opened from the Files combo box on the toolbar or from the “Open” dialog. The combo box on the toolbar provides a drop list of all the shape files in the current directory and provides a convenient way of “browsing” the files. The Open dialog is of most use for opening a file in another directory. Once the required base shape is loaded, a new shape file can be created by saving to a new name from the “Save As” dialog. To display the dialog, go to the “File” menu and select “Save As”.



The “Save As” dialog will appear.

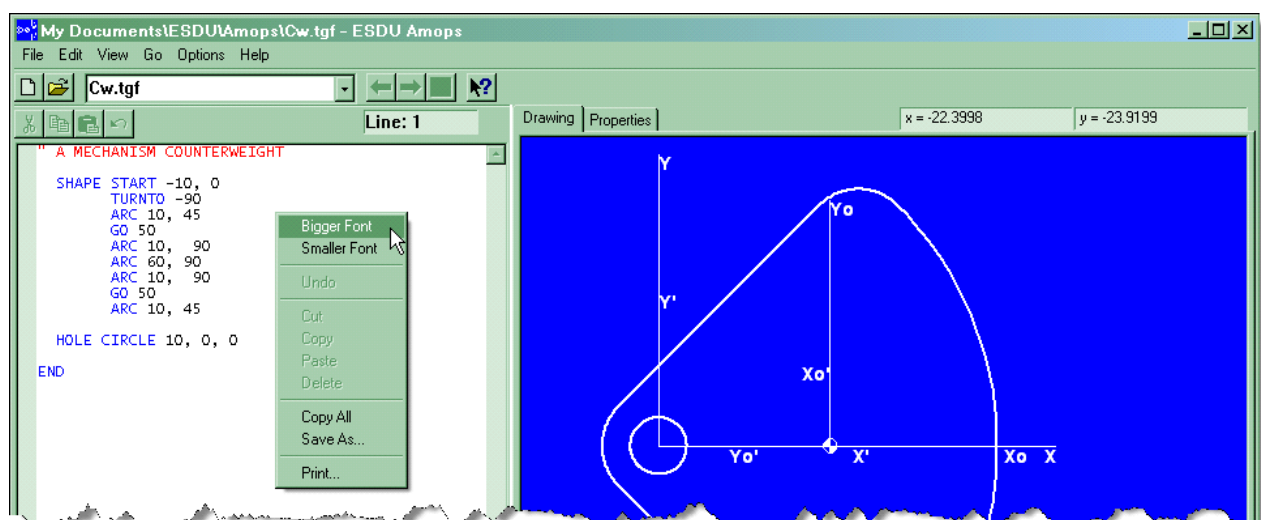


Enter a name for the new shape in the “File name” field and then click the “Save” button. A new shape file will have been created with the specified name (the old shape file is preserved).

2.4 Entering and Editing Graphics Commands

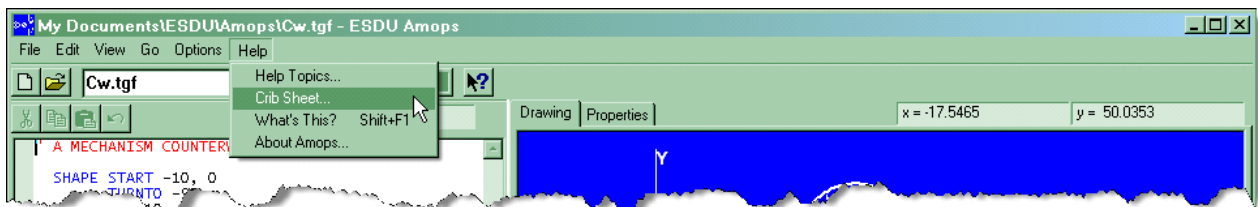
The graphics commands defining a shape are displayed in a specialised Edit pane that provides colour syntax highlighting to distinguish between keywords (blue), parameter values (black), and comments (red) and ignored text (green). Note also that the line number of the edit caret is displayed near the top right hand corner of the pane.

This Edit pane provides the usual editing options of Undo, Cut, Copy, Paste and Delete which are available from the “Edit” menu of the application menu. These editing options are also available from the Edit pane context menu obtainable by clicking the right mouse button. Additional options on the context menu allow the font size to be increased or decreased and the contents of the Edit pane to be printed, saved to a file or placed on the clipboard.

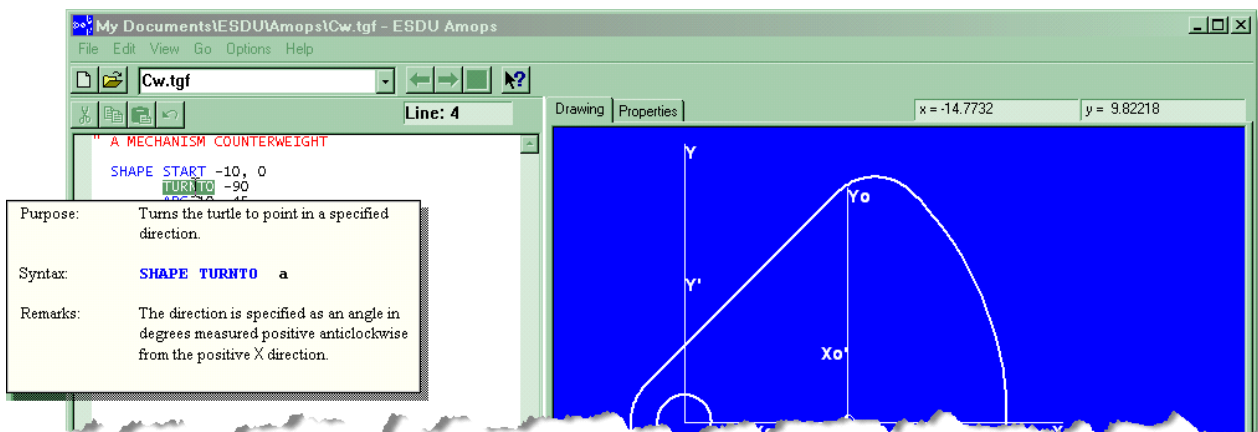


In addition to the usual Undo operation, which allows individual editing operations to be reversed, two further levels of undoing or reversing unwanted editorial changes are available from the application menu. The “Undo All” option on the “Edit” menu allows the current editorial changes to be discarded thereby restoring the graphics commands to the start of the current session (or to the last time “Save Changes” was selected from the “File” menu). A further level of undoing unwanted editorial changes is provided by the backup file. Amops can be configured to create a backup file automatically when editorial changes are saved (see Section 2.8). If it is later decided that these saved changes are not needed, the graphics commands can be restored from the backup file by selecting “Revert to Backup” on the “File” menu. Note that both of these options are potentially destructive and the user is prompted to confirm the operation.

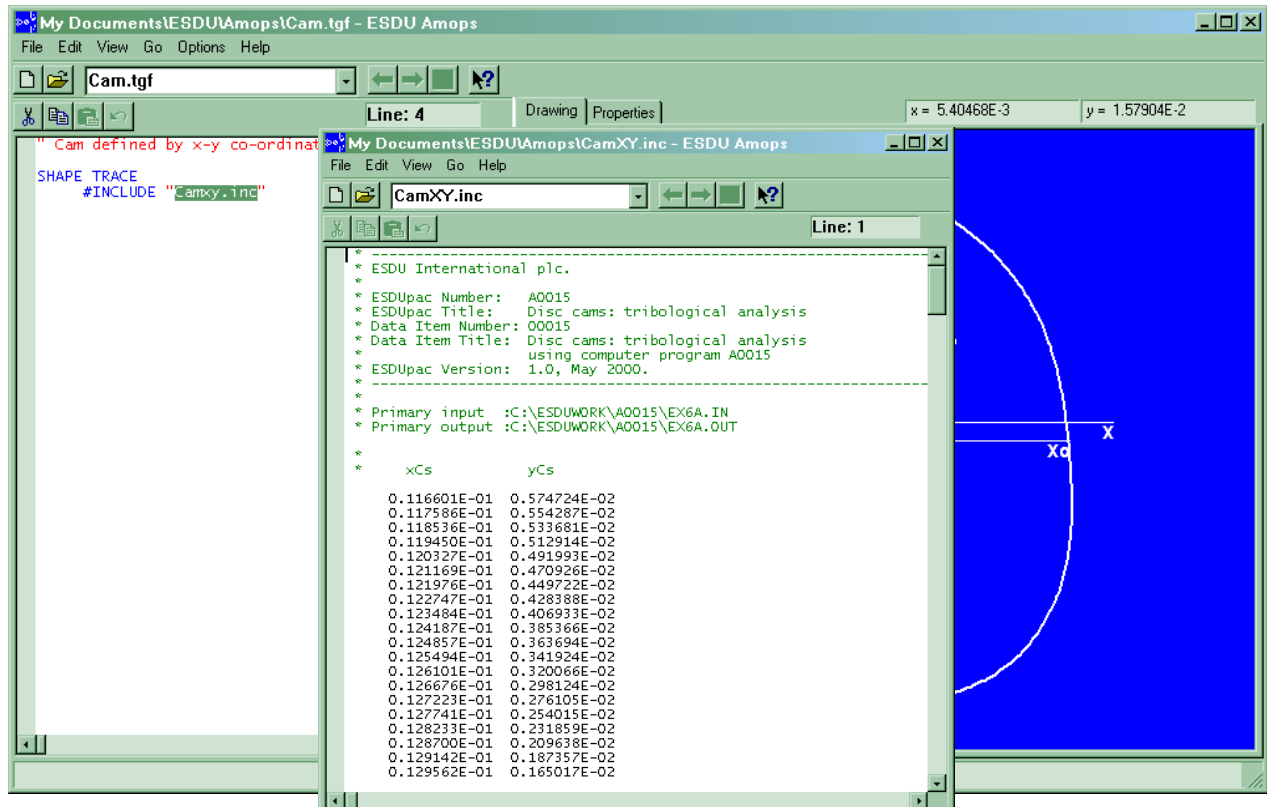
The Amops graphics commands language is very simple and examples of its use are described in Section 3. A formal definition of the language is given in Appendix A. A “Crib Sheet” help window, that provides a single page summary of the language, can be displayed from the “Help” menu.



Also, context help on individual keywords (highlighted blue) can be obtained by pressing the F1 function key while the edit caret is over the keyword or by double clicking the left mouse button on the keyword.

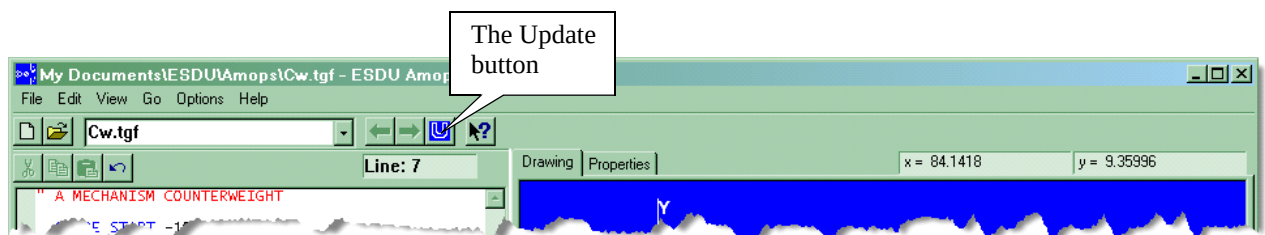


As in many other programming and scripting languages, the contents of another file can be included into a parent file. In Amops, these include files are automatically hyperlinked to the parent file so that double clicking the left mouse button on the include file name opens the file in a subsidiary editor. The same editing options are available in this subsidiary editor as in the main Amops Edit pane.



2.5 Updating the Results Pane

When the graphics commands in the Amops Edit pane, or in an include file, have been edited, the Results pane will no longer be consistent with the new changed set of commands and will need to be updated. The Results pane can be updated from the "Update" option on the application "Go" menu or, more conveniently, by clicking the Update button on the toolbar. This button is normally disabled but becomes enabled when editing changes have been made, thus providing a distinctive indication of when an update is required.



As soon as the graphics commands have been edited and updated output has been obtained, it will be observed that one of the pair of Data History buttons on the toolbar will become activated.