CR Engineering Analysis & Computing

DynaTool Help Index

Description of DynaTool
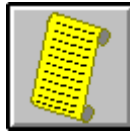
User manual and help data base

Theory manual

Verification manual

Program history

Release Notes

Known bugs and failings

Wish list

> Programming today is a race between software engineers striving to build bigger and better idiot proof programs, and the Universe trying to produce bigger and better idiots.   So far, the Universe is winning. *--- R. Cook*

Commands

- [File menu](#)
- [Edit menu](#)
- [Array menu](#)
- [Tools menu](#)
- [View menu](#)
- [Plot menu](#)
- [Window menu](#)
- [Help menu](#)

File menu commands

The File menu offers the following commands:

New	Creates a new **DynaTool** document.
Open	Opens an existing **DynaTool** document.
Close	Closes an opened **DynaTool** document.
Save	Saves an opened **DynaTool** document using the same file name.
Save As	Saves an opened **DynaTool** document to a specified file name.
Export	Exports arrays as formatted text files
Print	Prints a document.
Print Preview	Displays the document on the screen as it would appear printed.
Print Setup	Selects a printer and printer connection and paper size.
Exit	Exits **DynaTool**.

Edit menu commands

The Edit menu offers the following commands:

Edit Response Spectrum   Edit response spectrum array parameters
Edit Time History   Edit time history array parameters

Array menu commands

The array menu contains the following commands:

New	Create a new array
Delete	Delete an array
Rename	Rename an array

Tools menu commands

The array menu contains the following commands:

Fill Table	Fill an array
Time History	Generate time histories
Response Spectrum	Generate response spectra
Fourier	Calculate Fourier coefficients
Integration/Differentiation	Integrate or differentiate arrays
Algebra	Carry out algebraic calculations on and between arrays, including mathematical functions
Setup	Program set-up sub menu

Setup menu (Tools menu)

The tools->setup menu contains the following commands:

Time History   Set parameters for time history generation
Response Spectrum   Set parameters for response spectrum generation

View menu commands

The View menu offers the following commands:

Toolbar   Shows or hides the toolbar.
Status Bar   Shows or hides the status bar.

Plot menu commands

The View menu offers the following commands:

Define Plot   Creates and edits plot definitions.
View Plot   Selects a defined plot for display.
Appearance   Sets appearance attributes for the plot.
Show Attributes   Sets display attributes.
Font   Sets the fonts to be used on the plot.

Window menu commands

The Window menu offers the following commands, which enable you to arrange multiple views of multiple documents in the application window:

New Window   Creates a new window that views the same document.
Cascade   Arranges windows in an overlapped fashion.
Tile   Arranges windows in non-overlapped tiles.
Arrange Icons   Arranges icons of closed windows.
Window 1, 2, ...   Goes to specified window.

Help menu commands

The Help menu offers the following commands, which provide you assistance with this application:

DynaTool Help	Offers you an index to topics on which you can get help.
Using Help	Provides general instructions on using help.
About	Displays version information for **DynaTool**, including the difference between "free ware" and "fully supported".

New command (File menu)

Use this command to create a new document in **DynaTool**.

You can open an existing document with the [Open command](#).

Shortcuts

Toolbar:

Keys: CTRL+N

Open command (File menu)

Use this command to open an existing document in a new window.   You can open multiple documents at once.   Use the Window menu to switch among the multiple open documents.   See Window 1, 2, ... command.

You can create new documents with the New command.

Shortcuts

Toolbar:
Keys: CTRL+O

File Open dialogue box

The following options allow you to specify which file to open:

File Name

Type or select the filename you want to open.   This box lists files with the extension you select in the List Files of Type box.

List Files of Type

Select the type of file you want to open:

DynaTool files have the extension .dnt

Drives

Select the drive in which **DynaTool** stores the file that you want to open.

Directories

Select the directory in which **DynaTool** stores the file that you want to open.

Network...

Choose this button to connect to a network location, assigning it a new drive letter.

Close command (File menu)

Use this command to close all windows containing the active document.   **DynaTool** suggests that you save changes to your document before you close it.   If you close a document without saving, you lose all changes made since the last time you saved it.   Before closing an untitled document, **DynaTool** displays the Save As dialogue box and suggests that you name and save the document.

You can also close a document by using the Close icon on the document's window, as shown below:

Save command (File menu)

Use this command to save the active document to its current name and directory.   When you save a document for the first time, **DynaTool** displays the Save As dialogue box so you can name your document. If you want to change the name and directory of an existing document before you save it, choose the Save As command.

Shortcuts

   Toolbar:
Keys: CTRL+S

      *Note: In **DynaTool** the file-save toolbar button and the file-save menu item are active only when the data has changed since the last save or since the file was read from disc.*

Save As command (File menu)

Use this command to save and name the active document.   **DynaTool** displays the [Save As dialogue box](#) so you can name your document.

To save a document with its existing name and directory, use the [Save command](#).

File Save As dialogue box

The following options allow you to specify the name and location of the file you're about to save:

File Name

Type a new filename to save a document with a different name.   A filename can contain up to eight characters and an extension of up to three characters.   **DynaTool** adds the extension you specify in the Save File As Type box.

Drives

Select the drive in which you want to store the document.

Directories

Select the directory in which you want to store the document.

Network...

Choose this button to connect to a network location, assigning it a new drive letter.

File Export Command (File menu)

Use this command to export data from arrays in an ASCII format which will allow the data to be imported into other programs including spreadsheets, finite element analysis systems and other engineering analysis tools.   **DynaTool** opens the File Export dialogue box

File Export Dialogue Box

This dialogue box enables the export of data from **DynaTool** arrays in a standard ASCII text format using a space, comma or tab separator.

The Export dialogue box consists of two list boxes, the list of filled arrays and an output list.   The list of available arrays consists only of those which are filled, it does not differentiate by type.   The export list shows the order in which arrays will be exported.   To nominate arrays for export, highlight them using the mouse.   Once arrays have been highlighted, the **>> Add >>** button will activate.   Pressing the button adds the array names to the export list.   To export an array more than once, add its name to the list the required number of times.

The list of array names in the export list should be in the order in which they are required for the export operation.   If one or more of the items in the export list are highlighted, the names can be deleted.   This does not actually delete the arrays from the data base.   If a single name is highlighted and there is more than one name in the list, then the **Move up** and/or **Move down** buttons activate as available.

Once arrays have been listed for export, two other buttons activate, the **Filename** button and the **Format** button.   When a file has been nominated for the save, its pathname is displayed at the top of the dialogue box.

Only when the export list contains one or more array names and a filename has been nominated and a format has been set does the **OK** button activate.   Pressing OK exports the data.

File Export Format

The File Export Format dialogue defines the layout of the file.   The dialogue has four panes, 3 for input and one to indicate the file layout.

File Type

Select the text file type from the radio buttons, comma separated variable, space separated variable or tab separated variable.   Only one file type can be selected.   CSV is useful for spreadsheets and data bases, TAB for word processors, especially if the data is to be tabulated.

File Layout

The data can be set on the file in one of seven pre-defined layouts.

1.   a1x   a1y a2x   a2y   a3x   a3y - Writes array data in columns in x, y format.   This allows the exporting of data with different x sequences.
2.   a1x   a1y a2y a3y - Writes array data in columns with the x data from the first array in the first column, then the y data from all arrays in sequence following.
3.   x, y blocks - Writes array data in rows as x, y pairs.   Writes all pairs, one to a row for the first array, then repeats for each subsequent array.
4.   x block, y block, x block, y block - Writes array data as one entry per row, writes all the x data for the first array, then all the y data for the first array, then repeats the sequence for each subsequent array.
5.   x block followed by y blocks - Writes array data as one entry per row, writes all the x data for the first array, then all the y data for the first array, then repeats with the y data for each subsequent array.
6.   x blocks followed by y blocks - Writes array data as one entry per row, writes all the x data for each array in turn, then all the y data in each array.
7.   Y blocks only - Writes only the y array data as one entry per row, writes all the y data for each array in turn.

Headers

The headers option controls additional data to be written to the file.   By default the headers are applied, they can be switched off by checking the check boxes.

No File QA Header switches off the addition of a header to the top of the file which indicates the DynaTool version used to write the file, the file name and the date written.

No Block/Column Headings switches off the column headings which are written at the beginning of each block of data.   This information is useful when the data is read into a spreadsheet or word processor file to provide indications of the column content.

File Layout Sample

This area of the dialogue gives a simple clue as to the layout to be expected on the file.

Comma Separated Variable File

Data fields are separated by commas, two consecutive commas will indicate a default value, usually zero. The usual file name extension is .csv, although any other extension is permitted by **DynaTool**.

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Space Separated Variable File

Data fields are separated by one or more spaces.   Consecutive spaces are treated as single spaces.
The usual file name extension is .txt, although any other extension is permitted by **DynaTool**.

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Tab Separated Variable File

Data fields are separated by tabs, two consecutive commas will indicate a default value, usually zero. The usual file name extension is .txt, although any other extension is permitted by **DynaTool**.

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1, 2, 3, 4 command (File menu)

Use the numbers and filenames listed at the bottom of the File menu to open the last four documents you closed.   Choose the number that corresponds with the document you want to open.

Exit command (File menu)

Use this command to end your **DynaTool** session.   You can also use the Close command on the application Control menu.   **DynaTool** prompts you to save documents with un-saved changes.

Shortcuts
    Mouse: Double-click the application's Control menu button.

Keys: ALT+F4

Edit Response Spectrum (Edit Menu)

Use this dialogue to change the properties of response spectrum arrays.

The array to be modified is selected from the drop down list.   The list will only contain arrays which have been flagged as being response spectra.

The damping value can be altered using the edit box.
The response spectrum type and the response type can be changed using the radio buttons.

New Array command (Array menu)

Use this dialogue to create a new **DynaTool** array.   Arrays are created empty, and are given an initial sequential unique name, which can be overwritten.

Toolbar: [N]

Array Type

The default array type is a <u>standard array</u>.   The array can be defined as a <u>response spectrum</u> or as a <u>time history</u>.

Motion Definition

If the array type is defined as a time history or a response spectrum, the motion definition radio buttons will be activated.   Select the necessary type.

Array Name

In **DynaTool** arrays are identified by their name.   When the dialogue opens, the array is automatically assigned a name, which is made unique using a sequential number.   Array names **MUST** be unique, and the dialogue forces this.   There is no restriction on characters used, spaces are legal, therefore, the name can be a description.   There are some <u>reserved characters</u> which should be used with care. These characters are used by **DynaTool** as tags to enable generated data to be uniquely named.

Fill Array Now

Arrays are created empty, if this box is checked then the <u>Fill Table</u> is activated when the **OK** button is pressed.

Delete Array command (Array menu)

Only active if arrays exist.

This command will delete the array selected from the drop down menu.   A confirmation box is presented before actual deletion takes place.

Deleting an array releases all resources and adjusts the linking of the array list.   Recovery is not available.

Rename Array command (Array menu)

Only active if arrays exist.

This command will rename an array.   Array names **<u>MUST</u>** be unique, and the dialogue forces this. There is no restriction on characters used, spaces are legal, therefore, the name can be a description. There are some <u style="color:red">reserved characters</u> which should be used with care.   These characters are used by **DynaTool** as tags to enable generated data to be uniquely named.

Standard Array Type

A standard array is defined as having X and Y data (abscissa and ordinate), but with no special properties.

Response Spectrum Array Type

A response spectrum array is defined as having the special properties of a response spectrum.   In particular this is a damping property and a motion type, Acceleration, Velocity or Displacement.

Time History Array Type

A time history array is defined as having the special properties of a time history.   In particular this is a motion type, Acceleration, Velocity or Displacement.

Reserved Characters

Certain characters and character combinations are used by **DynaTool** for identification of internally defined tables, and as the result of generated data such as time histories or response spectra.

< ... > The < and > characters are used to delimit textual tags.   Take care if they are used in the combination   indicated.

Fill Table (Tools menu)

Only active if arrays exist.

The fill dialogue enables the filling or refilling of arrays.

Toolbar:

Array Name

Select the array to be filled from the drop down list.   The list will contain the names of all defined arrays to allow re-filling.   Arrays can also be filled as the result of operations in the calculation module.   The calculation module will allow more complex array fills, however, there must be at least one filled array for this to be active.

X Data

Filling for the X (abscissa) data.   The X array can be filled using one of several functions:

File	Read X data from an ASCII disc file. (file reading formats)
Linear	The X data is a linear progression with a starting value, a constant increment, a final value and a number of terms. The program requires one of the following:
	interval, start value, end value
	start value, end value, number of items
	interval, start value, end value, number of terms
Log	The X data is a log progression with a starting value, a final value and a number of terms.
Exponential	The X data is an exponential progression with a starting value, a final value and a number of terms.
Log10	The X data is a log base 10 progression with a starting value, a final value and a number of terms.
10 Power	The X data is a power 10 progression with a starting value, a final value and a number of terms.
List	The X data is to be input by hand.

The fill functions fill the X data with the prescribed number of terms, including the start and finish values, with a constant increment based on the function.

X Array Fill Data

This area of the dialogue is only activated for those fill functions which require it,   It is not activated for *file* and *list* options.

The X Interval option is only active for the linear fill option.

Y Data

Filling for the Y (ordinate) data.   The Y array can be filled using one of several functions:

File	Read Y data from an ASCII disc file. (file reading formats)
y = mx + c	The Y data is generated from a linear equation.
y = k.log(x) + c	The Y data is calculated based on the log of the X value.

y = k.log10(x) + c	The Y data is calculated based on the log base 10 of the X value.
y = k.exp(x) + c	The Y data is calculated based on e power X value.
y = k.10**x + c	The Y data is calculated based on 10 power X value
Enter as list	The Y data is to be input by hand.
Random Value	The Y value is entered as a random number.
Asin(kx + P) ... (radians)	The Y value is filled based on the sine of the X value.
Asin(Pi(kx + P)) ... (radians)	The Y value is filled based on the sine of the X value.

Y Array Fill Data

This area of the dialogue is only activated for those functions which require it,   It is not activated for *file* and *list* options.

The edit boxes are activated and labelled to identify the expected contents.   There are no default values.

X & Y Data From The Same File

If both the X and Y data is indicated as being from a disc file, this check box is activated.   If it is checked, then both arrays are read from the same file.   (file reading formats)

Time History Generation (Tools menu)

Only active if filled response spectrum array(s) exist

This dialogue sets up and activates the time history generation.

Toolbar:

Time History Array

Use this drop down list to identify which array to use to store the generated time history.   If a suite of time histories is to be generated, then this name becomes the base name.   The drop down list will only contain arrays flagged as being time history arrays.

If you want to create a new array for the target, select the **[New Array]** item.   This will activate the new array dialogue before generation begins.

Target Response Spectrum

This drop down will contain a list of all of the defined and filled response spectrum arrays.   The selected response spectrum is chosen as the target response spectrum for the generated time histories.   A target response spectrum **MUST** be declared.

Time Envelope

This area of the dialogue defines the time history duration and the rise and decay times.   The method of defining the envelope is selected using the radio buttons.

The **Define Envelope** option allows an envelope with a linear rise and decay.   The duration gives the overall length of the time history.   If the combined rise and decay times exceed the time history duration, then an error is flagged.

The **Array Envelope** option allows a more complex envelope to be defined in an array.   The drop down list will display all the available standard arrays.

Iteration Control

Time Step sets the time step for the time history time interval, this is a constant value.

Iteration Limit sets the number of iterations to be used in the time history calculation.

Time History Features

This is a sub dialogue which sets various features for the time histories.

This dialogue consists of a set of check boxes to activate options.

Baseline Correction applies a correction to the generated time history to ensure that the displacement finishes at (or very close to) zero.

ASCE 4-86 Compatibility makes the frequency content of the time history comply with the requirements of ASCE 4-86.

NUREG 008 Compatibility makes the frequency content of the time history comply with the requirements of NUREG 008.

Note:
To generate time histories outside the seismic range, or to generate time histories which do not necessarily need to comply with NUREG 008 or ASCE 4-86 **BOTH** of these options should be switched off.

Random Phase Angle this applies a randomly generated phase angle to the sine wave components of the time history.   If this option is checked a seed can be entered in the **seed** box.   If the seed is 0, then the seed for the random number generator is taken from the system clock.   Any other seed is taken as a fixed seed, enabling repeatable calculation.

Generate Time History Set enables the generation of time history sets from the defined target response spectrum.   If this option is selected, then the random phase angle *should* also be set to allow the time histories generated to differ from each other.

If the **2 Horizontal 1 Vertical** option is chosen, then a suite of three time histories are generated with the vertical data internally scaled by 2/3.   Otherwise, enter a number in the **Generate Set of** edit box.

Note: testing has shown that sets generated with the random phase angle are statistically independent.

Response Spectrum (Tools menu)

Only active if filled time histories exist

Toolbar:

Response Spectrum Array

Use this drop down list to identify which array to use to store the generated response spectrum.   The drop down list will only contain arrays flagged as being response spectrum arrays.

If you want to create a new array for the target, select the **[New Array]** item.   This will activate the new array dialogue before generation begins.

Response Spectrum Type

These radio buttons select the type of response spectrum to be generated.

Amplitude

Should the response be calculated from the absolute amplitude of the single degree of freedom oscillator, or from its amplitude relative to the input.

Time History Array

A drop down list of time history arrays from which to generate the response spectrum.

Fourier (Tools menu)

Original Array

This drop down list contains all arrays available for transformation into the domain selected with the **domain** radio button. The list changes and only includes candidate arrays.

The title of the calculation attributes box changes with function. If the translation is to the **frequency domain** then the tile is **xxxx Input Array Time History Points**, where xxxx is the number of points in the input array.

The transform is carried out using a **F**ast **F**ourier **T**ransform algorithm, therefore, the input and output array lengths need to be powers of two. The **Output Array Frequency Points** drop down box will list three lengths, one shorter than the input, and two longer than the input. Select the required length.

Fourier Spectrum Smoothing Window this is the size of the window over which the Fourier coefficients are averaged when plotting the Fourier spectrum.

If the translation is to the **Time Domain** then the region is titled **Input Array Fourier Frequency**. The only box to be filled is the time step for the output time history.

Output Array

Use this drop down list to identify which array to use to store the generated Fourier data. The drop down list will only contain arrays flagged as being of the type relating to the required output domain.

If you want to create a new array for the target, select the **[New Array]** item. This will activate the new array dialogue before generation begins.

Integration/Differentiation (Tools menu)

Only active if filled arrays exist

Input Array

This drop down list contains a list of all available arrays.

Output Array

This drop down list contains a list of all arrays available to take the output, including that chosen for the input.   The input an output can be the same.

If you want to create a new array for the target, select the **[New Array]** item.   This will activate the new array dialogue before generation begins.

Integration Constant

A constant used as the initial value for the integration.

Integrate - button to execute integration.

Differentiate - button to execute differentiation.

Work in Frequency Domain check box is activated if the input array is a response spectrum.   This allows the integration/differentiation to be carried out in the frequency domain.

Algebra (Tools menu)

Only active if filled arrays exist

Toolbar:

Array Calculation Dialogue

This dialogue allows algebraic calculation on and between arrays.   The idea is to build a function in the calculation window, which will be executed when the **OK** button is pressed.   The syntax of the function is described later.   (Syntax).   The expression can be typed directly into the edit window by using the keyboard, data can be added using the calculator style keys in the dialogue, or a combination of both. Syntax checking occurs when OK is selected, or it can be carried out using the "**Check syntax"** button.

Array List

This region of the dialogue provides a list of arrays to be used in the calculation.   The radio buttons allow filtering of the list.   This filtering only affects the contents of the drop down list, it does not change any array names input to the function.   The array name can be automatically pasted into the function, (Paste Array)

X Values

In **DynaTool** there is no requirement for all of the arrays to use the same X or abscissa values.   For the calculation, the target array has to have an X value set, the X Values sub section allows different methods of filling the X values.

Use All X Values the calculations will be carried out at all X values from all arrays used in the calculation. Take care as this can lead to very long target arrays, and it could also lead to adjacent X values which are separated by very small intervals which may cause problems in using other functions.   The values in the X array are sorted into order, either ascending or descending, depending upon the ordering in the selected arrays.   If there is a conflict, then a dialogue is presented to resolve the conflict.

Use Target Array the calculation will be carried out using the X values present in the target array, if the target array already has X values.   If the target array does not have any X values, (a new array for instance), then the first array in the expression is used.   A warning is issued.

Use Array selecting this radio button activates the array list to allow an array to be selected to access its X value list.   This array does not have to be a part of the calculation.

When carrying out calculations, Y values are interpolated or extrapolated from the data in any array, therefore, it is not necessary for all arrays to have the same X values.   If the calculation contains response spectrum arrays, an option dialogue is presented to determine whether or not to use log/log interpolation on these arrays.

Functions

The functions drop down list allows pasting (Paste Function)of mathematical functions or pre-defined constants to the function window.   These functions act on the argument, which can be the Y values of a named array, or on a constant value or an expression.   (See syntax)

The following functions are available:

Abs(y)   Takes the absolute value of the argument.

Acos(y)	Returns the arc cosine of the argument in radians. -1 < arg < 1
Asin(y)	Returns the arc sine of the argument in radians. -1 < arg < 1
Atan(y)	Returns the arc tangent of the argument in radians.
Ave(y1, y2, ...)	Returns the average of the arguments. There is no limit to the number of arguments.
Cos(y)	Returns the cosine of the argument which is assumed to be in radians.
Cosh(y)	Returns the hyperbolic cosine of the argument.
exp(y)	Returns e power of the argument. Can also be entered as e^y
Int(y)	Returns the integer value of the argument.
Ln(y)	Returns the natural logarithm of the argument. Arg > 0
Log10(y)	Returns the logarithm base 10 of the argument. Arg > 0
Max(y1, y2, ...)	Returns the maximum of the arguments. By mixing array values and constants, clipping can be achieved.
Min(y1, y2, ...)	Returns the minimum of the arguments. By mixing array values and constants, clipping can be achieved.
Sin(y)	Returns the sine of the argument which is assumed to be in radians.
Sinh(y)	Returns the hyperbolic sine of the argument.
Sqrt(y)	Returns the square root of the argument. Arg >= 0
Std(y1, y2, ...)	Returns the standard deviation of the arguments.
Tan(y)	Returns the tangent of the argument which is assumed to be in radians.
Tanh(y)	Returns the hyperbolic tangent of the argument.
Var(y1, y2, ...)	Returns the variance deviation of the arguments.

Pre defined constants

The following functions insert constant values to an expression.

AMaxVal(array)	The absolute maximum Y value of an array.
AminVal(array)	The absolute minimum Y value of an array.
e	e = 2.718281828459
MaxVal(array)	The maximum Y value of an array.
MinVal(array)	The minimum Y value of an array.
Pi	Pi = 3.14159265359
xmax	The maximum X value of the target
xmin	The minimum X value of the target
xval	The current X value. Not actually constant.
ValAt(array, x)	The Y value from "array" at the value of X. The firat argument must be an array, the second argument can be any number or pre-defined constant, ValAt(array, xmax) for instance.

Entering the Expression

The function can be entered into the **Calculation** edit box in several ways;

By using the keyboard, position the cursor in the box using the mouse.
By using the keypad in the **Key Pad** section of the dialogue.
By using the **Paste Array** button. The array name selected from the drop down list is inserted at the current insert point.
By using the **Paste Function** button. This button is only active when a function or pre-defined constant

has been selected from the drop down list of functions.   The selected function is pasted into the calculation at the current insert point.   It may be necessary to manually insert data to the argument list for the function.
It is not necessary to use the paste buttons to insert array names or functions, they can be entered from the keyboard.

The **Undo Last** button will undo the last edit.   The number of undos available is indicated by the number in the button.

Scan Old Calculations checkbox.   **DynaTool** stores the last eight calculations entered in the **DynaTool**.ini file in the windows home directory.   By checking this box, the first three buttons change function to allow scanning of the stored calculations.   The **Next Calc** button gets the next calculation from the list, the **Prev Calc** gets the previous calculation.   The list is treated as a cyclic list, cycling to the beginning once the end is reached and visa versa.   The **Transfer** button transfers the chosen function to the calculation edit box.   Once a calculation is transferred, the **Scan Old Calculations** check box will be un-checked.   If no calculation is transferred, (by unchecking the **Scan Old Calculations** check box), the original content of the edit box is restored.   A transferred calculation can be edited as normal.

Check Syntax

The check syntax button checks the syntax of the function at any time during entry of the function.   No calculation takes place.

The following syntax rules are defined for the calculation;

array_name = expression

where function is made up of array names and functions as described above.   The normal rules for mathematical functions apply, with the following operators:

^ raise to power
* multiply
/ divide
+ plus
- minus

When dividing, if the program detects a zero denominator it replaces it with a very small value, 1×10^{-12}. Evidently, this may have a knock on effect, please take care.   No warning is issued.

() brackets are used to promote parts of the calculation.

Array Names
Array names **MUST** be quoted, e.g. "First floor E/W spectrum"

Functions and Pre-declared Constants
Functions can be entered in any case, the arguments must be enclosed in parentheses and separated by comma's.

Pre-defined constants can be entered in any mix of upper and lower case.   If a constant takes arguments, they must be enclosed in parentheses and separated by comma's.

Sub Expressions
The overall expression can contain sub-expressions, enclosed in parentheses.   The first token of an expression can be a minus sign, therefore, allowing the negating of array values.

e.g. "array" = -"array"

There is no programmed limit to the nesting depth, it has been assumed that practical limits will prevail.

Overall Expression
There **MUST** be a target array to the left hand side and there **MUST** be an equals sign.   Array names to the right hand side of the equation **MUST** all exist.   If the array named to the left hand side does not exist, then it will be created.

The syntax checker is invoked when the **OK** button is pressed or by pressing the **Check Syntax** button.

Time History - Set-up

The time history set-up dialogue sets attributes for time history generation.   Changes made in this dialogue are stored in the **DynaTool**.ini file in the windows home directory, and remain in effect until changed.

Improve High Frequency Calculation
This feature is used in isolation from that set for response spectra.   It should be noted that this greatly slows calculation of response spectra and has a significant effect on time required to calculate a time history.

Frequency Content

These radio buttons control the frequency content of the generated time histories.   The **Low** option fits one frequency between the ASME recommended frequencies, **Medium** fits 3 between each frequency and **High** uses a function to insert a large number of frequencies.   The frequency content will affect the ability to match the response spectrum at frequencies other than the ASME/NUREG frequencies. Evidently, the more frequencies, the longer the calculation time.

Response Spectrum

The time history set-up dialogue sets attributes for time history generation.   Changes made in this dialogue are stored in the **DynaTool**.ini file in the windows home directory, and remain in effect until changed.

Improve High Frequency Calculation
This feature improves the calculation of the response spectrum at high frequencies by interpolating between time points on the time history.   The resolution factor is used to control the calculation, the higher the number, the better the fit, but also the longer the run time.

File Reading Formats

Files from which array data is to be read should be comma or space separated data.   Both comma and space separation can be used in the same file.   Data is read sequentially from the file, irrespective of column layout.   Each line is read left to right in turn.   If X and Y data is to be taken from the same file, then data is read X, Y, X, Y, X, Y ..... to the end of the file.

Toolbar command (View menu)

Use this command to display and hide the Toolbar, which includes buttons for some of the most common commands in **DynaTool**, such as File Open.   A check mark appears next to the menu item when the Toolbar is displayed.

See Toolbar for help on using the toolbar.

Toolbar

The toolbar is displayed across the top of the application window, below the menu bar.   The toolbar provides quick mouse access to many tools used in **DynaTool**,

To hide or display the Toolbar, choose Toolbar from the View menu (ALT, V, T).

Click	To

   Open a new document.

   Open an existing document.   **DynaTool** displays the Open dialogue box, in which you can locate and open the desired file.

   Save the active document or template with its current name.   If you have not named the document, **DynaTool** displays the Save As dialogue box.   This button is only active if there is something to save or if the current data changes.

   Print the active document.

   Print preview.

   Create a New Array

   Fill Arrays - only active if there are arrays to fill.

   Generate Time Histories - only active if response spectra exist.

   Generate Response Spectra - only active if time histories exist.

   Array Calculus - integration and differentiation - only active if arrays exist.

   Array Algebra - only active if arrays exist.

Status Bar command (View menu)

Use this command to display and hide the Status Bar, which describes the action to be executed by the selected menu item or depressed toolbar button, and keyboard latch state. A check mark appears next to the menu item when the Status Bar is displayed.

See Status Bar for help on using the status bar.

Status Bar (View menu)

MEM Kb	RES %	CAP		
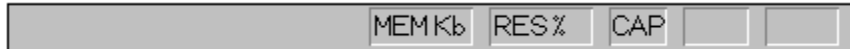
The status bar is displayed at the bottom of the **DynaTool** window.   To display or hide the status bar, use the Status Bar command in the View menu.

The left area of the status bar describes actions of menu items as you use the arrow keys to navigate through menus.   This area similarly shows messages that describe the actions of toolbar buttons as you depress them, before releasing them.   If after viewing the description of the toolbar button command you wish not to execute the command, then release the mouse button while the pointer is off the toolbar button.

The right areas of the status bar indicate which of the following keys are latched down:

Indicator	Description
MEM Kb	Available system memory in Kbytes.
RES %	Remaining system resources in %.
CAP	The Caps Lock key is latched down.
NUM	The Num Lock key is latched down.
SCRL	The Scroll Lock key is latched down.

Define Plot (Plot menu)

Only active if filled arrays exist

Plot Name

Each plot is named to allow multiple plot definitions to be created.   Names should be unique.   If an existing name is selected from the list, then its contents are displayed for editing.

Define Plot

The define plot area displays in a list all existing arrays.   To add an array to the plot list, highlight, then use the **Add** button or double click the entry.   Multiple entries can be selected and added by using the <shift> and <control> keys with the left mouse button.   See Windows help for details.

To remove entries from the plot definition, highlight the array name(s) and use the **Remove** button, or double click.   **Clear All** removes all definitions from the plot list.

On exit, the plot will be displayed.

Plot definitions are saved to file with array data.   The plot being displayed when the file is saved is displayed when the file is re-opened.

View Plot (Plot menu)

Only active if plot definitions exist

Lists the named plot definitions to allow a different plot to be displayed.   Select the required plot from the list.   Double click the plot name, or us **OK** to exit and select.

Appearance

The plot->Appearence menu contains the following commands:

Axis ...   Sets the attributes for the plot axes
Grid Lines …   Sets the attributes for the major and minor grid lines
Titles …   Sets the titles for the plot
Borders …   Format the plot borders and text backgrounds
Lines …   Format the plot lines

Show Attributes

The plot->Show Attributes menu contains the following command menus:

Titles   Check mark menu to switch titles on/off
Axis Values   Check mark menu to switch axis values on/off
Log Axes   Check mark menu to switch between log and normal axes
Borders   Check mark menu to switch borders on/off
Axis Attributes   Check mark menu to modify axis display
Show Legend   This check mark toggles the legend display on and off

Font

The plot->Font menu contains the following dialogues:

Main Title …	Sets the font for the main title
Sub Title …	Sets the font for the sub title
X Axis Title …	Sets the font for the X axis title
Y Axis Title …	Sets the font for the Y axis title
X Axis Values …	Sets the font for the X axis values
Y Axis Values …	Sets the font for the Y axis values
Legend Title …	Sets the font for the legend title
Legend …	Sets the font for the legend text

The standard Microsoft font selection dialogue is activated.

Axis Appearance

This dialogue formats the axis for the plot.   Some functions are available in other dialogues.

The following are repeated for the X and The Y axis.

Axis Type

Check this box for a log axis.   [See also](#)

Automatic Range

The default is for the axes to be automatically scaled based upon the data to be plotted.   If the data changes, e.g. if an array is added to the plot definition or if the contents of an array are changed, the axes will re-scale.

User Defined Scaling

Using this area of the dialogue, the axis scales can be set manually.

Axis Display

This area of the dialogue alters the display of the axes.   Check boxes for display.

Draw Axis.   [See also](#)
Switches the axis display on and off.

Tick Marks.   [See also](#)

Switches the display of tick marks on and off.   Tick marks cannot be displayed without the axis being displayed.

Plot At 0.

Forces the axis to be plotted at the O value, otherwise, it is the bottom or left of the plot.

Axis Colour

Allows the definition of the axis colour.

Line Thickness

Allows setting of axis line thickness.

[Switch titles on/off](#)
[Switch axis values on/off](#)

Plot Titles

This dialogue sets the text to be displayed as titles on the plot.   Displaying of titles is controlled by other dialogues.

The following titles can be defined: **Main Title, Sub Title, X Axis Title, Y Axis Title, Legend Title.** Formatting of titles and displaying of titles is controlled separately.

Plot Borders

This dialogue sets the border and background colours, and border line thicknesses.   The border being formatted is selected with the radio buttons to the left of the dialogue.   To the right, line thickness and colour is selected along with the line colour.

Chart border   the border around the whole chart.   A chart cannot have a clear background.

Plot Border   the border around the plot.   A plot cannot have a clear background.

Legend Box   the border around the legend box.   If the background is set to clear it will be the same colour as the chart background.

Legend Box Title titles cannot have borders, but they can have backgrounds.   If the background colour is clear, then the plot background is used.

Main Title
Sub Title
X Axis Title
Y Axis Title

Backgrounds are not available for the axis annotation.

Plot and Grid Lines

This dialogue sets line styles and colour for plotted lines.   The same dialogue is used for the plotting of data lines and for the plotting of grid lines.

Plot Titles Menu

Plot->Show Attributes->Titles

This check mark menu consists of a set of toggles which activate the showing of titles.   Five items activate/de-activate display of titles:
Main Title, Sub Title, X Axis Title, Y Axis Title

The **All Titles** option toggles all titles on/off.

Plot Axis Values

Plot->Show Attributes->Axis Values

This check mark menu consists of two toggles to switch the display of axis values on and off:
X Axis Values, Y Axis Values

Log Axes

Plot->Show Attributes->Log Axes

This check mark menu toggles between log and normal axes:
Log X Axis, Log Y Axis

Plot Borders

Plot->Show Attributes->Borders

This check mark menu toggles borders on/off:
Chart Border, Plot Border, Legend Border

The following check marks switch the text backgrounds on/off
Main Title, Sub Title, X Axis Title, Y Axis Title

The **All Borders** option toggles all borders on/off.

Axis Attributes

Plot->Show Attributes->Axis Attributes

This check mark menu toggles axis displays on/off:
Plot X Axis, Plot Y Axis, X Axis Ticks, Y Axis Ticks

Switching off the axis display, switches off the tick mark display.   Tick marks cannot be displayed without the axis being displayed.

New command (Window menu)

Use this command to open a new window with the same contents as the active window.   You can open multiple document windows to display different parts or views of a document at the same time.   If you change the contents in one window, all other windows containing the same document reflect those changes.   When you open a new window, it becomes the active window and is displayed on top of all other open windows.

Cascade command (Window menu)

Use this command to arrange multiple opened windows in an overlapped fashion.

Tile command (Window menu)

Use this command to arrange multiple opened windows in a non-overlapped fashion.

Tile Horizontal command (Window menu)

Use this command to vertically arrange multiple opened windows in a non-overlapped fashion.

Tile Vertical command (Window menu)

Use this command to arrange multiple opened windows side by side.

Window Arrange Icons Command

Use this command to arrange the icons for minimised windows at the bottom of the main window.   If there is an open document window at the bottom of the main window, then some or all of the icons may not be visible because they will be underneath this document window.

1, 2, … command (Window menu)

DynaTool displays a list of currently open document windows at the bottom of the Window menu.   A check mark appears in front of the document name of the active window.   Choose a document from this list to make its window active.

DynaTool **Help (Help menu)**

Use this command to display the opening screen of Help.   From the opening screen, you can jump to step-by-step instructions for using **DynaTool** and various types of reference information.

Once you open Help, you can click the Contents button whenever you want to return to the opening screen.

Using Help command (Help menu)

Use this command for instructions about using Help.

About command (Help menu)

Use this command to display the copyright notice and version number of your copy of **DynaTool**.

Print command (File menu)

Use this command to print a document.   This command presents a [Print dialogue box](#), where you may specify the range of pages to be printed, the number of copies, the destination printer, and other printer setup options.

Shortcuts

Toolbar:
Keys: CTRL+P

Print dialogue box

The following options allow you to specify how the document should be printed:

Printer
    This is the active printer and printer connection.   Choose the Setup option to change the printer and printer connection.

Setup
    Displays a [Print Setup dialogue box](#), so   you can select a printer and printer connection.

Print Range
    Specify the pages you want to print:
    All   Prints the entire document.
    Selectio   Prints the currently selected text.
    n
    Pages   Prints the range of pages you specify in the From and To boxes.

Copies
    Specify the number of copies you want to print for the above page range.

Collate Copies
    Prints copies in page number order, instead of separated multiple copies of each page.

Print Quality
    Select the quality of the printing.   Generally, lower quality printing takes less time to produce.

Print Progress Dialogue

The Printing dialogue box is shown during the time that <<YourApp>> is sending output to the printer.   The page number indicates the progress of the printing.

To abort printing, choose Cancel.

Print Preview command (File menu)

Use this command to display the active document as it would appear when printed.   When you choose this command, the main window will be replaced with a print preview window in which one or two pages will be displayed in their printed format.   The <u>print preview toolbar</u> offers you options to view either one or two pages at a time; move back and forth through the document; zoom in and out of pages; and initiate a print job.

Print Preview toolbar

The print preview toolbar offers you the following options:

Print
Bring up the print dialogue box, to start a print job.

Next Page
Preview the next printed page.

Prev Page
Preview the previous printed page.

One Page / Two Page
Preview one or two printed pages at a time.

Zoom In
Take a closer look at the printed page.

Zoom Out
Take a larger look at the printed page.

Close
Return from print preview to the editing window.

Print Setup command (File menu)

Use this command to select a printer and a printer connection.   This command presents a [Print Setup dialogue box](#), where you specify the printer and its connection.

Print Setup dialogue box

The following options allow you to select the destination printer and its connection.

Printer
> Select the printer you want to use.   Choose the Default Printer; or choose the Specific Printer option and select one of the current installed printers shown in the box.   You install printers and configure ports using the Windows Control Panel.

Orientation
> Choose Portrait or Landscape.

Paper Size
> Select the size of paper that the document is to be printed on.

Paper Source
> Some printers offer multiple trays for different paper sources.   Specify the tray here.

Options
> Displays a dialogue box where you can make additional choices about printing, specific to the type of printer you have selected.

Network...
> Choose this button to connect to a network location, assigning it a new drive letter.

DynaTool Bugs and Failings

Bugs, **DynaTool** is perfect, but then the World is flat!

Well maybe there are some ...

At release 1.0.3 all known bugs have been removed.

Shortcomings

Response Spectrum Calculation
Response spectrum calculation is carried out on absolute values only.

Complex Numbers
The program only uses complex numbers internally whilst executing Fast Fourier Transforms.   It is intended to allow general access to complex numbers.

Memory Availability
The program displays an indication of the available system memory, but it does not always monitor failure to allocate new memory resources.   Traps need to be added, and these will go in as the program develops.   This should only be a problem when very large problems are being tackled.

DynaTool History

Version	Date	Release Description
v.1.0.2	July 1996	Pre-release restricted freeware version (beta test).

The following features are disabled for the freeware version:

       Export files;
       Printing;
       Storage of mathematical functions.

The following features are disabled due to incomplete development:

       Mathematical processing between arrays;
       Printing, disabled for freeware, is not of a high enough quality for release;
       List filling of arrays;
       Storage of plot definitions.

The help file is definitely incomplete.

Version	Date	Release Description
v.1.0.3	Dec 1996	Release version.

All of the above problems fixed except for list filling which has been removed.

Calculator works correctly.

Plot formatting features added.

Time history seismic frequency range frequency content now optional.

DynaTool Release Notes

Version 1.0.2

This release of the program is a pre-release (beta version) of the **freeware** version.   There are functions which are incomplete, these have either been de-activated or they work to a certain point to allow their intent to be seen.

Useful functions, such as printing and ASCII file exporting of results have been purposely disabled.   The bulk of the program works to give a full idea of the program capability.

The original idea was to support seismic applications and some features are, therefore, biased. This will change, hopefully before the official release.

The program is modular, adding different processors is not too complex, therefore, ideas for further development will be accepted.

The capabilities for **freeware**, **shareware** and **fully supported** versions have yet to be worked out, as has the pricing structure.

Version 1.0.3

This release of the program is the first full release of the program.   Feature incomplete at the beta release have been completed.   The user help file has been completed.   Plotting has been improves.   Plot formatting has been added.

Time histories can now be generated in frequency ranges other than the seismic range.

DynaTool Theory Manual

DynaTool has some theoretical basis, but what is it?

DynaTool Wish List

I wish, I wish ...

OLE connection to Excel etc.
Calculating of cross correlation coefficients.
Addition of ability to sample input from the RS232 and parallel ports.
Ability to restart time history calculation to improve quality.
General access to Complex numbers.
Smoothing of response spectra
Peak broadening of response spectra
Other transforms

DynaTool Verification Manual

DynaTool has undergone some verification, but in many ways it is self verifying.

This document will have verification tests added in time.

DynaTool - Time and Frequency Domain Tool Kit

1.0 Introduction

DynaTool has been written to group together tools for the pre-processing and post processing of data from time and frequency domain analysis into a Microsoft Windows environment.   It was originally written to process data associated with seismic analysis, it is possible however that many routines will work adequately for other fields of study.   The program brings to the PC environment functions which to date have been the preserve of workstation and mini computer systems.   Used on a PC networked to a UNIX system, or by using data transfer, it will fit into the advanced engineering environment, and between the engineering and publication of results.

DynaTool has been written using the Microsoft Visual C++ which not only has the advantage of making the program compatible with MS Windows but it also means that the program is modular in nature thus allowing new analysis modules too be added at a later date.   The use of C++ also allows the program to grab memory as it is required, thus the initial load module is not too large.

DynaTool contains functions to generate time histories with random phase angles, response spectra and Fourier transforms.   In addition, a powerful user programmable calculation module allows the comparison and manipulation of stored data.   Array data can be combined, averaged, enveloped, clipped, scaled and much more.

DynaTool is a developing product.

2.0 Structure

DynaTool has been structured to allow free definition of data storage, almost completely in the control of the user.   Data is stored in dynamically allocated arrays which themselves are stored in classes.   Each array class contains the X and Y data, or the array can be defined internally by the program as a complex array, here the Y array is defined as an array of complex numbers with the X array real.   At the initial version of the program these arrays are used only for the Fourier transform from a real time domain series to the frequency domain.

The array classes are created as and when the user requires, they can also be deleted to release memory.   In theory each array can be up to 64 Kbytes in size, since all real numbers are stored as double precision the theoretical maximum array size is 8096 entries.

Data is recovered from the arrays using interpolation and extrapolation schemes, so the program is not restricted to working on data at stored values.   This allows inter-operation between arrays and the creation of new data sets from multiple input sets from different sources.   When working with response spectrum data the interpolation is based on a logarithmic scheme.

<u>3.0</u> What Does DynaTool **Provide**

DynaTool provides a collection of tools which are of use to engineers and scientists involved in seismic analysis.   The tools provided are based on those used for structural analysis, however, they are based on standard techniques and will be of use to other branches of time and frequency domain analysis.

- Time history from a response spectrum.   Suites of time histories from the same response spectrum including random seed for independence.   If a suite of 3 are requested this will be two horizontal and one vertical with the response spectrum amplitudes multiplied by 2/3.
- Response spectrum from time history using both equal time steps and unequal time steps.
- Fourier transform from time domain to frequency domain and back.
- Check statistical independence between groups of arrays.
- Carry out algebraic operations between arrays.   (Not matrix algebra.)
- Envelope arrays.
- Import data from text files.
- Export arrays as text files.
- Plot array data.
- Print and plot reports.

<u>4.0</u> Why use DynaTool?

Why use **DynaTool** in place of spreadsheets and bespoke software?

DynaTool has been written to group functions together, many of which people   will have in their personal tool kit as individual isolated programs and spreadsheets.   **DynaTool** groups these into one package to ease the post processing of dynamic analysis data.   Since it has been designed to work with arrays only it is more efficient than a spreadsheet.   It will allow the arrays to be processed in many ways including creating new data by use of array algebra.   The resultant can be written for input into other programs such as Finite Element Analysis programs used in structural analysis.

Written with the processing of seismic data in mind, it is not necessarily true that this is the only type of data for which **DynaTool** will be of use.   The data is internally represented as vectors, therefore, the program will be of use to anyone processing such data forms.

DynaTool will develop over the years to include new capability.