

EESy Solutions

Engineering Equation Solver Newsletter

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Welcome

This is the 48th issue of EESy Solutions, a newsletter that provides news, tips, and other updates for users of the Engineering Equation Solver software. This issue provides a brief description of some features of EES that you may not be aware of. This is only a partial list of the many capabilities of the software but hopefully you will find a few new things to explore. Those features that are only available in the professional version are designated with a brown vs a blue header. In each section a link is provided to an online resource with more details.

Whether you are an experienced EES user or a newcomer to the program, we hope that you will find something useful among the topics listed in this newsletter.

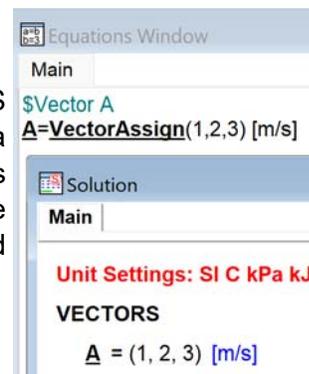
EES has been commercially available for more than two decades. Previous issues of EESy Solutions can be downloaded from <https://fchartsoftware.com>.

Vector Variables

It is possible to define special, vector variables in EES. To declare that an EES variable is a vector you must use the **\$Vector** or **\$Vector2D** directive followed by a list of one or more vector variables. Each variable that is defined as a vector in this way will have either two or three scalar components that are designated with the subscripts _x, _y, and (if 3d) _z. All of the normal vector operations (e.g., dot and cross products) are available for vector variables.

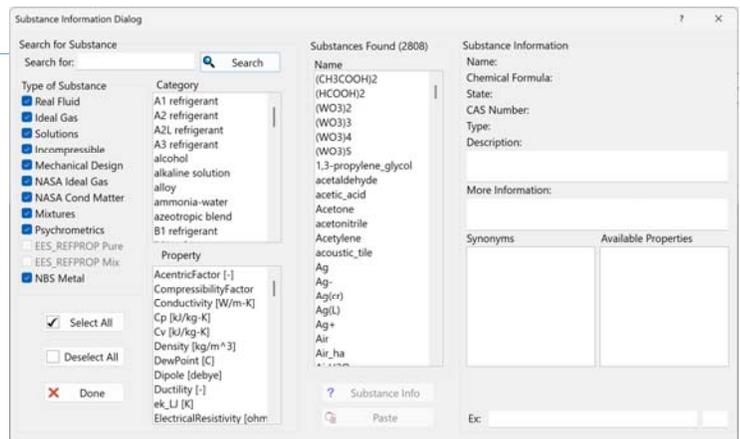
Radiation View Factors

The Heat Transfer Library in EES includes many functions and procedures that make it easy to solve complex heat transfer problems. This includes one of the most comprehensive libraries of radiation view factors available anywhere. To access the more than 100 view factors functions from the radiation view factor library select Function Information from the Options menu and then select the Heat Transfer & Fluid Flow radio button. Select Radiation View Factors from the drop down menu.



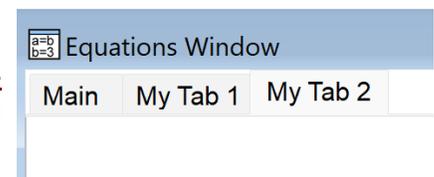
Substance Information Dialog

Most users know that property data for many substances are available in EES. Did you know that you can quickly search through the more than 2800 substances and find information about each one using the [Substance Information Dialog](#)? Select Substance Info from the Options menu in order to see what property information is available and select the model most appropriate for your application.



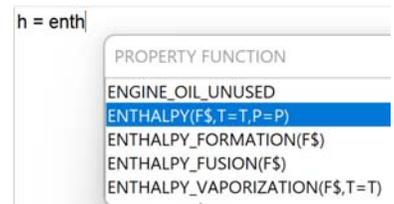
Equation Window Tabs

Did you know you could organize your EES program into separate [Equation Window Tabs](#)? In addition to the Main tab you can define additional tabs to hold either separate EES programs or parts of a single program. The parts in the tabs are connected with the [\\$InsertTab](#) directive



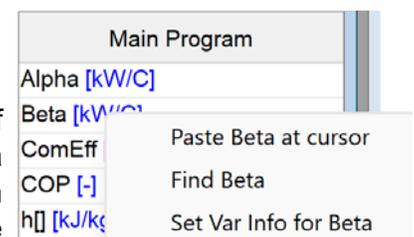
AutoComplete Feature

EES now contains an [AutoComplete](#) feature that provides suggestions for code as you type. To activate or deactivate the AutoComplete feature select the AutoComplete control in the status bar that appears at the bottom of the Equations Window. The AutoComplete box auto-populates based on the letters that are being typed to help avoid making mistakes when selecting from the many functions, procedures, substances, etc. that are available in EES.



Variable Information Palette

The [Variable Information Palette](#) in the Equations Window provides a list of all of the variables that are associated with the EES code. Right-clicking a variable in this palette finds each instance (one at a time) of the variable in the code. Left-clicking brings up a menu that allows you to either paste the variable name at the cursor location, find the variable or set the variable information (e.g., units and limits) for that variable.



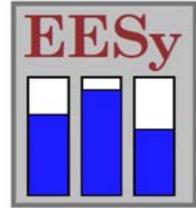
EES YouTube Channel

Our [YouTube channel](#) dedicated to video tutorials, case studies, and new features already has more than 1000 subscribers? These videos are organized into playlists and also listed on the [F-Chart Software website](#). Users can post questions and comments in the community section of this channel. These videos as well as other EES examples can be searched from the [Learn section](#) of the F-Chart Software website.



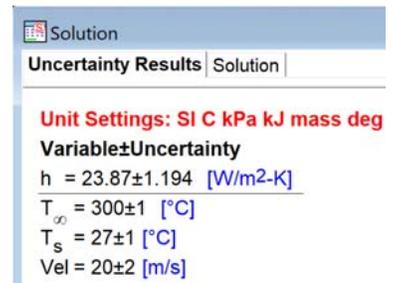
EESyGrader

Are you running a large enrollment class like Thermodynamics or Statics? [EESyGrader](#) provides an automated way to grade assignments that have been solved in EES. Students are provided with a header that contains the problem inputs and a template that includes the required output variables. They can prepare their solution and, at your discretion, compare their answers to the correct answer. EESyGrader will then open all of the submissions, adjust the inputs, and compare the resulting calculated outputs with those in a rubric. EESyGrader can generate grade reports and re-upload files that are consistent with the Canvas Learning Management System.



Uncertainty Propagation

EES allows not only a value and units to be assigned to each variable, but also its uncertainty. This capability is extremely handy for analyzing experimental data where uncertainty in measured variables must be propagated through a set of calculations to determine the associated uncertainty in a set of calculated variables. [Uncertainty propagation](#) allows you to select or design experimental instruments and reduce experimental data quickly and conveniently.



The EES AI Librarian

The [EES AI Librarian](#) can be accessed from the Toolbar by selecting the Ask AI button. You can ask the AI Librarian questions about using EES and even attach your code if you want help with debugging. The EES AI Librarian has been trained using all of the documentation available for the EES program (manuals, help pages, video transcripts, etc.) and is continuously updated as new features are added.

Enter your question here:
Is there a component library model for a combustor that provides the chemical composition of the exhaust gas?

Submit Question Status: Completed. Waiting for

Yes, the Component Library in EES provides a model for a combustor that can calculate the chemical composition of the exhaust gases. Specifically, the `Combustor3_CL` model in the library determines the equilibrium mole fractions of various gases resulting from adiabatic combustion. The product gases include CO₂, CO, H₂O, H, H₂,

The Component Library

Did you know that the [Component Library](#) in EES provides a range of models for many of the components that are commonly used in thermal fluid engineering systems. From pumps to combustors to compressors and beyond, you are likely to find a useful model at the appropriate level of sophistication in the Component Library. Access the Component Library by selecting the Component Library radio button in the Function Information Window and then select from the various categories to find the model you need.

The component library is divided into sections that correspond to combustors, compressors, duct systems (dampers, ducts, bends, etc.), fans and blowers, flow control (valves, capillary tubes, etc.), heat and mass exchangers, nozzles and diffusers, pumps, and turbines.

Function Information

Math and string functions Other EES .lib files
 Thermophysical properties Other .DLL files
 Heat Transfer & Fluid Flow
 Mechanical Design
 Component Library Flow Control

Angle Valve

Valves

Component Library
G.F. Nellis and S.A. Klein

Info View

Index

Ex: Call AngleValve_CL(F\$, T_in, P_in, Conc, m_dot, D_out, RelRough, fo, DELTAP)

Paste Done

Curve Fit Table Data

Data in a table can be used as the basis of a curve fit from the [Curve Fit Table Data](#) dialog which is available by selecting Curve Fit Table Data from the Tables menu? The form of the curve fit can be selected from a library of pre-loaded functions or you can enter your own, custom functional form. The data used in the fitting process can be weighted based on its uncertainty (either calculated using uncertainty propagation or entered separately) and the resulting fit is analyzed based on several metrics and can be plotted using error bars or error bands.

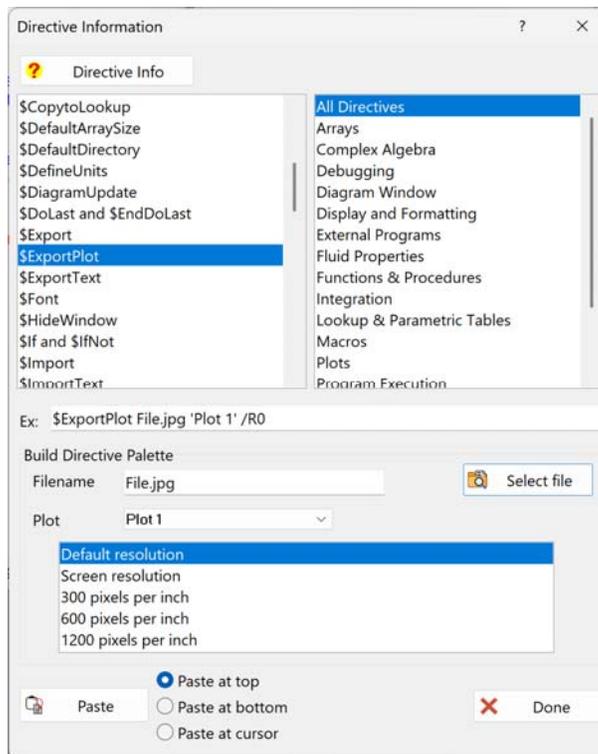
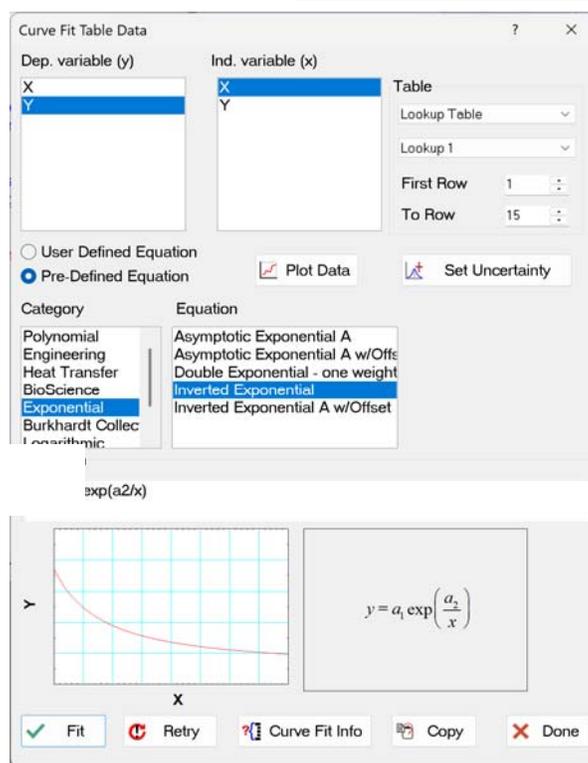
Distributables

Did you know that you can turn your EES programs into distributable stand-alone programs (i.e., executable files) that you can provide to your users. This capability coupled with the Diagram Window allows you to deploy fully functional modeling tools with a sophisticated graphical user interface (GUI) with minimal effort.

Directive Information Dialog

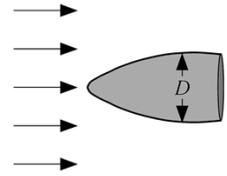
Directives are instructions to EES that occur prior to compiling the program itself. These can range from things as simple as setting the unit system ([\\$UnitSystem](#)) or tab settings ([\\$TabStops](#)) to exporting data ([\\$Export](#)) or making plots ([\\$NewPlot](#) and [\\$OverlayPlot](#)). There are more than 66 of these directives. More are always being added) so knowing what's available and how to use them can be challenging. The Directive Information Dialog is available from the Options menu and provides an easy way to navigate through the directives.

A palette is provided in the Directive Information Dialog that allows you to make menu-driven selections which will construct the directive of interest. The Paste button will then paste the resulting directive statement into the Equations Window for you.



Drag Coefficient Library

The Heat Transfer & Fluid Flow library now includes an extensive [drag coefficient library](#)? Drag coefficient correlations for external flow over most types of objects, from cylinders to wings to various vehicles, are available.



Equations in a Lookup Table

Lookup Tables hold data that you are processing in EES. Did you know that you can enter information in Lookup Tables using [column-based equations](#) just as you do in other spreadsheet programs like Excel?

Right-click on the column header and select Alter Values. Then select the Enter Equation radio button and enter any valid EES equation to fill in the column using #1 to indicate data stored in column 1 (for example). In the Professional, selecting the **Update automatically** check box causes the values in the column to update if any of the values used to calculate them change. If you select **Check units** then the equations that you entered will also be unit checked.

	T [C]	P [kPa]	h [kJ/kg]
Row 1	400	100	
Row 2	450	125	
Row 3	500	150	
Row 4	550	175	
Row 5	600	200	

h: Column 3

First Row: 1
Last Row: 5

Clear Values
 Enter Values
 Enter Equation
 FFT Transform

Enter Equation (Use #x to refer to values in column x)

#3= Enthalpy(Water,T=#1, P=#2)

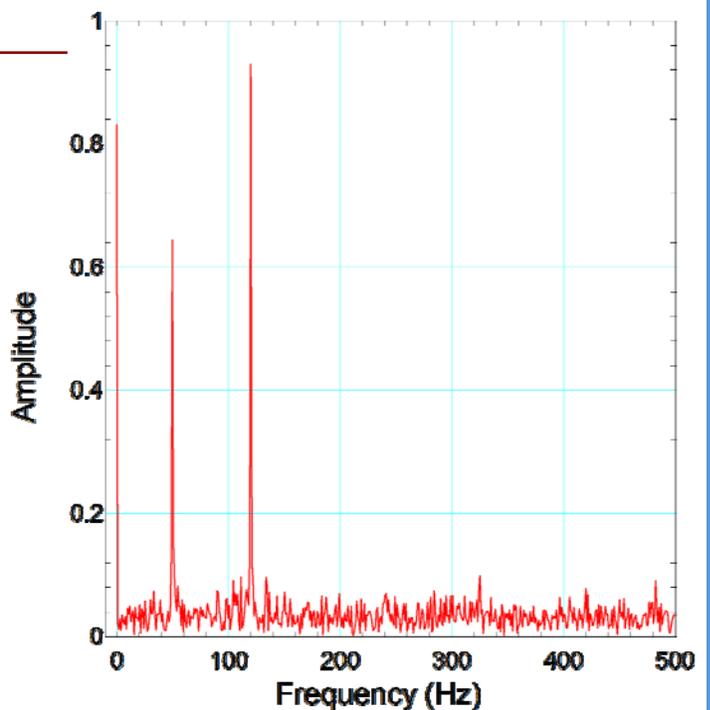
Update automatically Check units

OK Cancel

Fast Fourier Transform

As long as we're in the Alter Values dialog for a Lookup Table, did you know that you could carry out a [Fast Fourier Transform](#) (FFT) for data in a table? Select the FFT Transform radio button from the Alter Values dialog for the column containing the signal data. Then indicate the sampling time and select the columns where you would like the frequency and amplitude to be saved.

Once the FFT has been completed you can prepare plots of the amplitude as a function of the frequency (i.e., carry out a spectral analysis) for your data.



Recent Changes to EES

- The EES AI Librarian is an AI resource that has been trained on all available documentation for EES. You can ask it questions or even attach your code for debugging suggestions.
- Autocomplete is now available to provide an auto-populated list of functions, key words, substance names, etc. based on what you are typing.
- The Drag Coefficient library is now available as part of the Heat Transfer & Fluid Flow library and provides dimensional and nondimensional drag coefficient functions for a large range of shapes.
- EESyGrader has been improved and now allows outputs to be ordered in a way that matches your problem statement. Help has been integrated with the program and users can generate a set of re-upload files that can be used to provide grading feedback to the students in the Canvas Learning Management System.
- The Variable Information Palette now allows you to select between finding, pasting, or setting the characteristics of a variable when it is left-clicked on.
- The **Sum2D** function provides the sum of elements in a two-dimensional array.
- Thermodynamic and transport property data for **R422B**, **R511A**, chloroethane, n-hexadecane, n-docosane, isopropanol, and R1132(E) are now available.
- The thermodynamic data for sulfur dioxide has been updated.
- Thermodynamic and transport data for ethane, propane, isobutane, n-butane, ammonia, n-octane, R1243zf, R1234yf, and R1233zd(E) have been updated to use the most recent equations of state.
- Arrays can be hidden/shown within the Arrays Table by right-clicking the tab at the top of the table and checking/unchecking boxes from the resulting list.
- The time required to build a distributable file has been dramatically reduced.
- The Examples menu includes an option to Search Examples and Tutorials from a database that includes these resources.
- Online help can be accessed directly from the Equations Window by double-clicking the name of a function, keyword, etc.



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Instant Update & Technical Service

EES uses a different model for updating than most other programs. Each time that there is a change in the EES program, either to correct a problem or to add a new feature, the version number is incremented by 0.001 and the latest version of EES is placed on our website. EES has become very robust and stable. There have been many new versions of EES released with new capabilities since the last EESy Solutions was distributed.

Any user who has a current subscription to our Instant Update & Technical Service (IUTS) or Academic Update Service (AUS) can download the current version. All new Commercial and Professional licenses of EES are provided with a one year subscription of this service. The cost to continue IUTS or AUS after the first year is ~20% of the current cost of the program per year, provided that it is renewed within 12 months after expiration. Contact us if you wish to re-subscribe to IUTS or AUS.