Release Notes: Plate-Fin Module

INSTED Ver. 9.0

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Release Features

INSTED Ver. 9.0

The latest version of INSTED (Ver. 9.0) includes the following bug fixes and enhancements to INSTED 8.3.1

Bug Fixes and Enhancements to Plate-Fin Sizing/Optimization Solver

- For the Plate-Fin module in INSTED 8.3.1, when Sizing and Optimization projects are executed, some default bounds on the design parameters are hard-coded in the solver. However, it has been found that default bounds might not be suitable, and could actually sometimes lead to poor convergence of the Sizing/Optimization calculations. In INSTED 9.0, the following additional parameters have been added to the GUI to allow you to set the bounds.

  - Minimum total number of plates
  - Min. / max. hot side plate spacing
  - Min. / max. cold side plate spacing
  - Min. / max. hot side fin pitch
  - Min. / max. cold side fin pitch
  - Min. / max. hot side fin offset pitch / wavelength
  - Min. / max. cold side fin offset pitch / wavelength
  - Min. / max. hot side fin wave amplitude
  - Min. / max. cold side fin wave amplitude

  The interface to help you accomplish this task is shown below.

Min Number of Plates	= 4	
Max Hot Plate Spacing	= 0.05	m ▼
Min Hot Plate Spacing	= 5.e-4	m ▼
Max Cold Plate Spacing	= 0.05	m ▼
Min Cold Plate Spacing	= 5.e-4	m ▼
Max Hot Fin Pitch	= 0.1	m ▼
Min Hot Fin Pitch	= 2.e-4	m ▼
Max Cold Fin Pitch	= 0.1	m ▼
Min Cold Fin Pitch	= 2.e-4	m ▼
Max Hot Fin Offset Pitch / Wavelength	= 0.4	m ▼
Min Hot Fin Offset Pitch / Wavelength	= 8.e-4	m ▼
Max Cold Fin Offset Pitch / Wavelength	= 0.4	m ▼
Min Cold Fin Offset Pitch / Wavelength	= 8.e-4	m ▼
Max Hot Fin Wave Amplitude	= 0.05	m ▼
Min Hot Fin Wave Amplitude	= 1.e-4	m ▼
Max Cold Fin Wave Amplitude	= 0.05	m ▼
Min Cold Fin Wave Amplitude	= 1.e-4	m ▼

- In INSTED 9.0, a new "Edit" button has been added to allow you to set the bounds on the design parameters around their original values in a reference project.

Note that the "Edit' button is only available when a reference project is used

After clicking the "Edit" button, the following dialog box comes up to allow you to set the bounds on the design parameters. The options are:

➢ Same as in the reference project
➢ ± percentage (%) of the values in the reference project

Note that the dialog box also allows you to set bounds on specific parameters (plate size, number of plates, flow rate, fin geometries) and on specific streams (hot and cold, hot only, cold only). The interface to accomplish this is shown below:

Bug Fixes in INSTED UI

- In INSTED 8.3.1, if User-Defined Fin data is used, the settings of the original fin geometries would be overridden and would not be used in the rating calculations anymore. However, when the calculation results are exported to a downloadable Excel file, the original fin geometries are still exported. (Note that results are not affected by this error.) This bug has been fixed in INSTED 9.0.
- In INSTED 8.3.1, the fin height shown in the Multiple Rating results is wrong because an additional fin thickness has been inadvertently added to fin height. (Note that this error did not affect the calculated results.) However, this bug has been fixed in INSTED 9.0.
- In INSTED 8.3.1, the fonts in some Unit selection boxes are not correctly displayed, as shown below.

This bug has been fixed in INSTED 9.0.

Enhancement for INSTED UI

- In previous versions of INSTED, the term "Fin Height" used across the GUI appeared to confuse some users. To illustrate this issue, we use the rectangular fin below as an example.

Although the term "Fin Height" used in INSTED means the value of h', some users confused h with h', using h as the input for fin height, and interpreted the output fin height as $h.$ To resolve

this issue the term "fin height" has been replaced with "plate spacing" in all its occurrences in the input/output of the Plate-Fin module. The various occurrences are shown below.
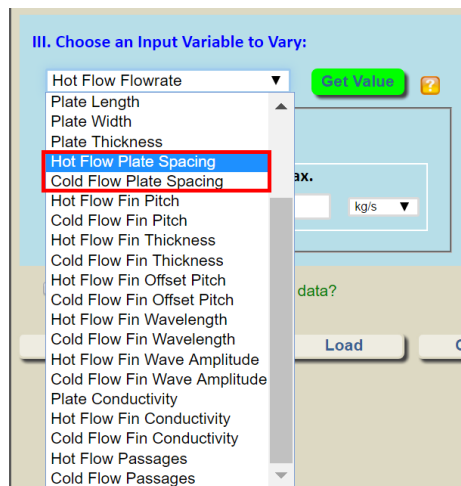
Fin Geometry setting:

III. Fin Properties:

Plate Spacing (h'):	0.0057	m ▼
Fin Thickness (t):	1.5e-4	m ▼
Fin Pitch (p):	0.002	m ▼
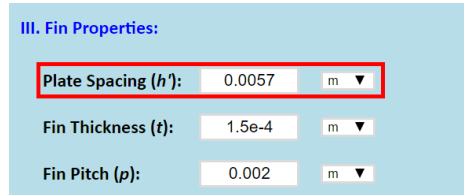
Rating Calculation results:

Fin Shape:	rectangular	
Fin Profile:	plain	
Fin Efficiency:	0.775128146	
Plate Spacing:	0.0057	m ▼
Fin Pitch:	0.002	m ▼
Fin Thickness:	1.5e-4	m ▼
Flow Length:	0.9	m ▼
Flow Width:	1.8	m ▼

Downloadable Excel file:

Hot Side								
Type	N-Fin or Channel	H (Plate Spacing)	t-fin	l or λ	2a	dh	Ac	A
[-]	[1/m]	[m]	[m]	[m]	[m]	[m]	[m²]	[m²]
rectangular/pla	500	0.0057	0.0002			0.0028	1.3861	243

Multiple Rating control parameters:

III. Choose an Input Variable to Vary:

Hot Flow Flowrate ▼   Get Value

Plate Length
Plate Width
Plate Thickness
Hot Flow Plate Spacing
Cold Flow Plate Spacing
Hot Flow Fin Pitch
Cold Flow Fin Pitch
Hot Flow Fin Thickness
Cold Flow Fin Thickness
Hot Flow Fin Offset Pitch
Cold Flow Fin Offset Pitch
Hot Flow Fin Wavelength
Cold Flow Fin Wavelength
Hot Flow Fin Wave Amplitude
Cold Flow Fin Wave Amplitude
Plate Conductivity
Hot Flow Fin Conductivity
Cold Flow Fin Conductivity
Hot Flow Passages
Cold Flow Passages

ax.

kg/s ▼

data?

Load   Cl

Sizing/Optimization bounds on design parameters:

Max Hot Plate Spacing	= 0.05	m ▾
Min Hot Plate Spacing	= 5.e-4	m ▾
Max Cold Plate Spacing	= 0.05	m ▾
Min Cold Plate Spacing	= 5.e-4	m ▾

Enhancement to INSTED UI

- In previous versions of INSTED, the thermal conductivity and density for Plate, Fin A, and Fin B have to be entered separately. However, the same solid material could be used for both the plate and the fins and user may not like to enter the same data more than once. In INSTED 9.0, when setting the thermal properties of fins, you should click the "🔲" button to see an additional dialog box where you can optionally ask to enter the same fin thermal conductivity and density as for plates. The GUI is shown below.
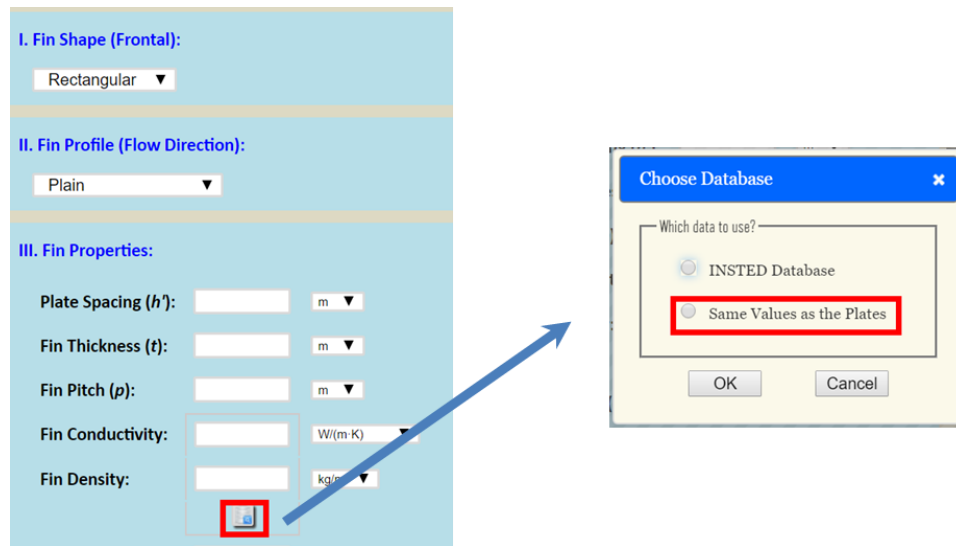
- In previous versions of INSTED, the Plate-Fin Multiple Rating module allows "Plate Conductivity", "Hot Stream Fin Conductivity", and "Cold Stream Fin Conductivity" to be incrementally, but independently, varied within in a range. In INSTED 9.0, a new control parameter "Solid Conductivity" is added to allow Plate, Hot Fin, and Cold Fin thermal conductivity to have the same value and be incrementally and simultaneously changed within a range. The GUI for accessing this capability is shown below.
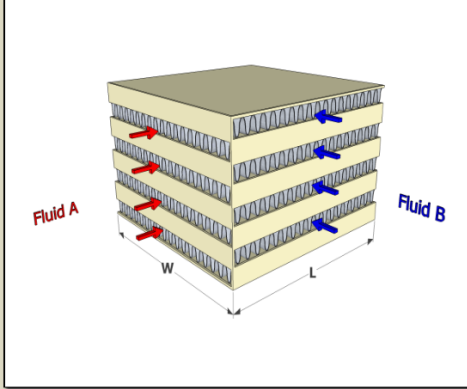
I. Project Name:

II. Choose a Rating Project:

Please choose ▼   View Details ?

III. Choose an Input Variable to Vary:

Hot Flow Flowrate ▼   Get Value ?

Plate Width
Plate Thickness
Hot Flow Plate Spacing
Cold Flow Plate Spacing
Hot Flow Fin Pitch
Cold Flow Fin Pitch
Hot Flow Fin Thickness
Cold Flow Fin Thickness
Hot Flow Fin Offset Pitch
Cold Flow Fin Offset Pitch
Hot Flow Fin Wavelength
Cold Flow Fin Wavelength
Hot Flow Fin Wave Amplitude
Cold Flow Fin Wave Amplitude
Plate Conductivity
Hot Flow Fin Conductivity
Cold Flow Fin Conductivity
All Solids Conductivity
Hot Flow Passages
Cold Flow Passages

x.

kg/s ▼

data?

Load   Close   Compute