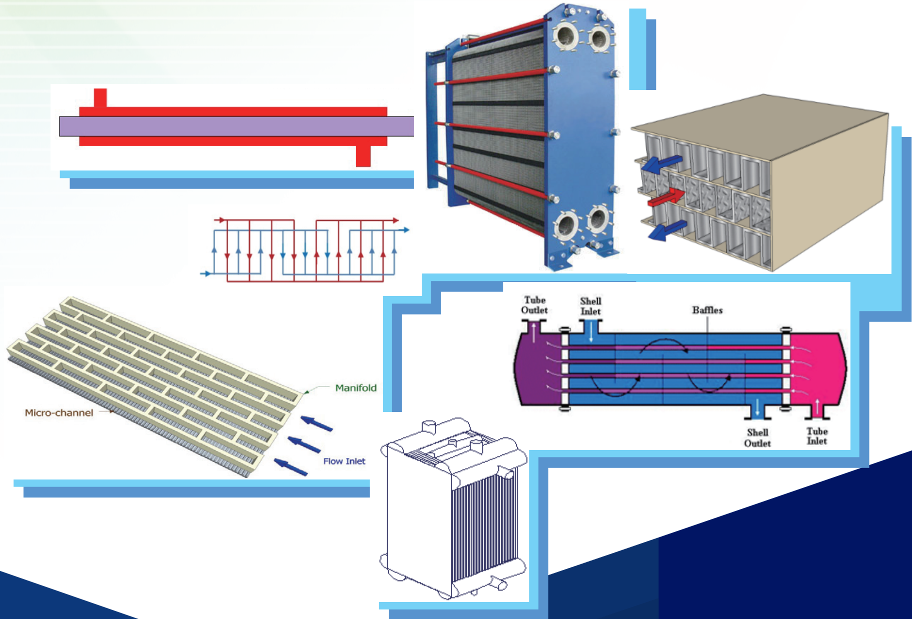
Pioneering engineering
analysis software
for next-generation engineers

INSTED®
Thermal Analysis Software

-Since 1993-



ttc tecnologies

INSTED THERMAL ANALYSIS SOFTWARE
Brochure

INSTED Modules

Heat Exchanger (HEX) Analysis Programs

- Plate-Fin Heat Exchanger
- Shell-and-Tubes Heat Exchanger
- Plate-Frame Heat Exchanger
- Concentric Tubes Heat Exchanger
- Manifolds-Microchannels
- 3D-Printed/Additively-Manufatured HEXs
- Smart Heat Exchangers

Basic Thermal-Hydraulic Analysis Programs

- Series Piping Systems
- Heat Transfer from Fin and Fin Arrays
- Heat Conduction in Composite Solids
- Flow Over Tube Banks
- Internal Flow with Heat Transfer
- External Flow with Heat Transfer

Two-Phase Models

- 37 Boiling & Condensation Models
- Modification for Enhanced Surfaces
- Incremental Method

Engineering Tools

- Thermal-Hydraulic Database
- Advanced Math Calculation Tool
- Engineering Units Converter

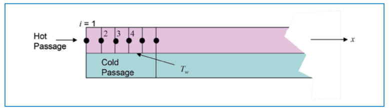
Fast, Accurate, and Realistic Analysis

Multiple HEX Design Tools

- Performance analysis (rating)
- Parameter analysis (multiple-rating)
- Preliminary design
- Sizing
- Optimization

HEX Simulation Model

- Bulk (ε-NTU)
- Discrete (differential equations)

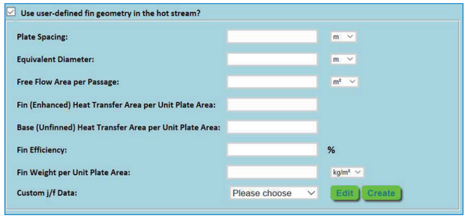


Advanced Optimization Algorithms

- Gradient method
- Adjoint-based method
- Genetic algorithm (GA)
- Advanced sensitivity analysis

Customizable Data

- Custom fluid properties
- Custom j/f data
- Custom fin geometry

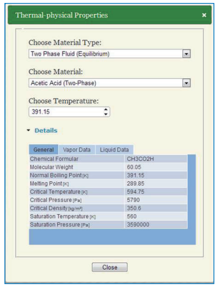


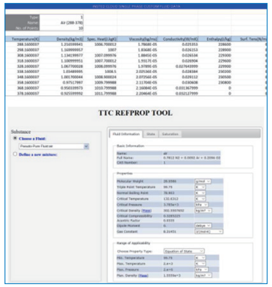
	Re	j	f
1	300.0	0.014	0.057
2	400.0	0.0117656	0.0495644
3	500.0	0.0098982	0.0397575
4	600.0	0.0085648	0.0332262
5	800.0	0.0067295	0.0253199
6	1000.0	0.005616	0.0202061
7	1500.0	0.0043949	0.0145536
8	2000.0	0.004023	0.0124148
9	3000.0	0.0037122	0.0105362
10	4000.0	0.0035233	0.0097063
11	5000.0	0.0033574	0.0092686
12	6000.0	0.0032642	0.0088961
13	8000.0	0.0030609	0.0084082

Integrated Analysis Environment

Integrated Thermophysical Properties Database

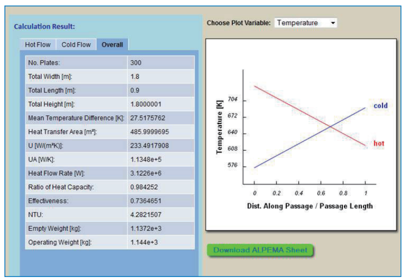
- INSTED solid/fluid database
- NIST's REFPROP
- User-defined fluid properties

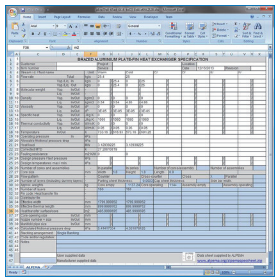




Result Plotting & Export

- Line plots along flow passage
- Exporting data to Excel file





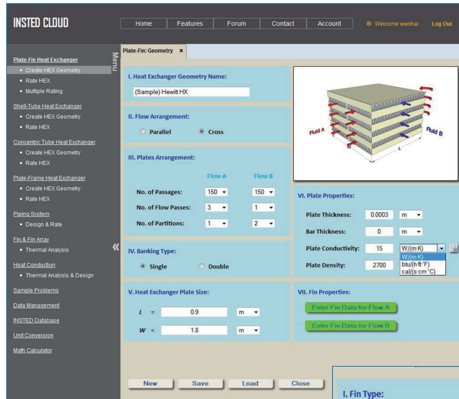
Unit Preference Setup

Unit Conversion On-the-Fly

Easy-to-Use Interface

Cloud Version vs Desktop Version

Cloud Version	Desktop Version
Access data in INSTED anywhere, anytime	Protect your data by running INSTED on your computer



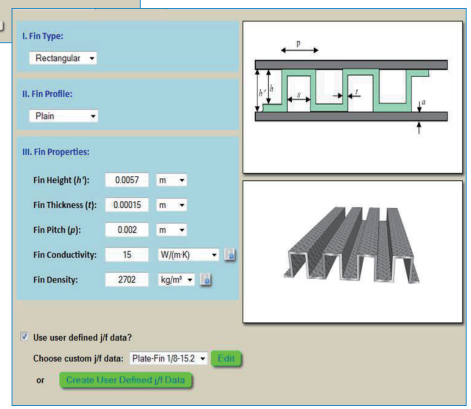


Plate-Fin Heat Exchanger

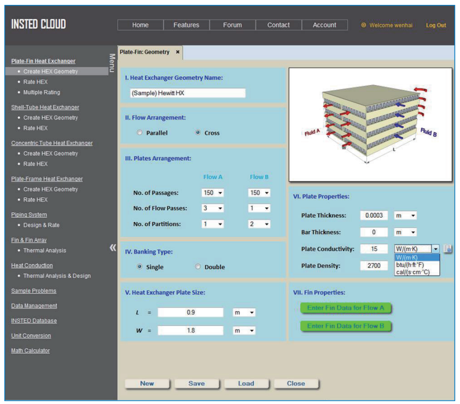
Features:

- Performance Analysis
- Parametric Rating Calculations
- Sizing & Optimization
- Custom j/f Data Input for Fins
- Kays & London Data for Fins
- User-Defined Fin Geometry Data

I. HEX Geometry

Different plate/flow arrangements

- Parallel or cross-flow
- Multiple flow passes
- Multiple partitions
- Single- or double-banking



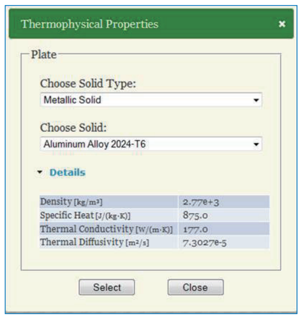
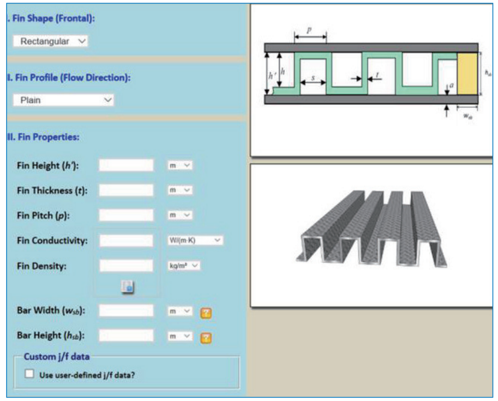


Plate-Fin Heat Exchanger

II. Fin Geometry



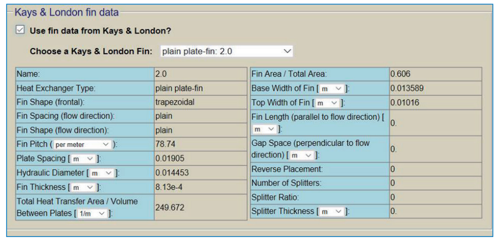
Fin types

- Rectangular
- Trapezoidal
- Triangle
- Wavy
- User-defined

Fin profiles

- Plain
- Herringbone
- Offset-strip
- User-defined

Kays & London fin data



Custom j/f data

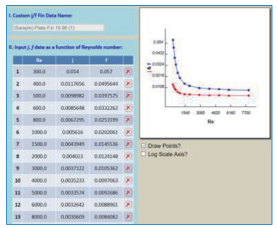
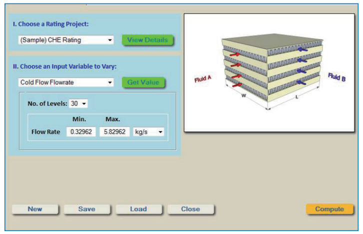
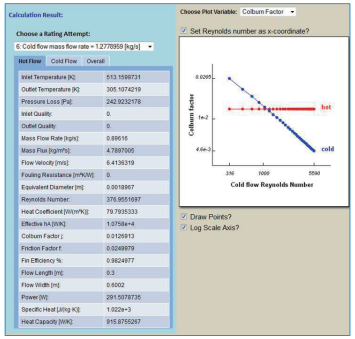


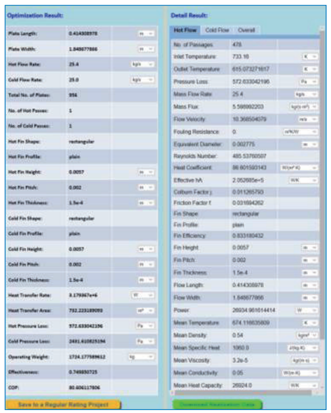
Plate-Fin Heat Transfer

Multiple Rating

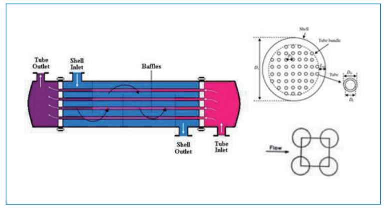




Optimization

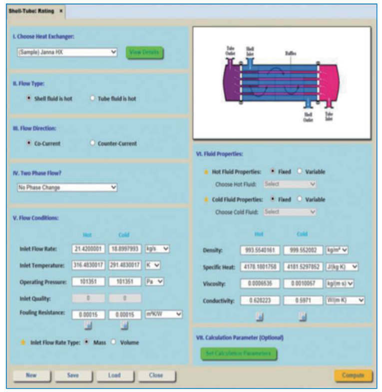


Shell & Tubes Heat Exchanger



Features

- Performance Analysis
- Parametric Rating Calculations
- Preliminary Design
- Two-Phase



Rate a shell-and-tubes heat exchanger by providing flow conditions

Types of Shells

- Generic
- TEMA-E
- TEMA-J
- TEMA-K
- TEMA-X

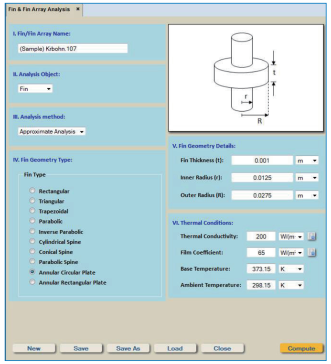
Types of Tube Bundles

- Square
- Rotated Square
- Triangle
- Rotated Triangle

Shell-Side Film Coefficients Calculation Methods:

- Kern's Integral
- Bell-Delaware
- Stream Analysis

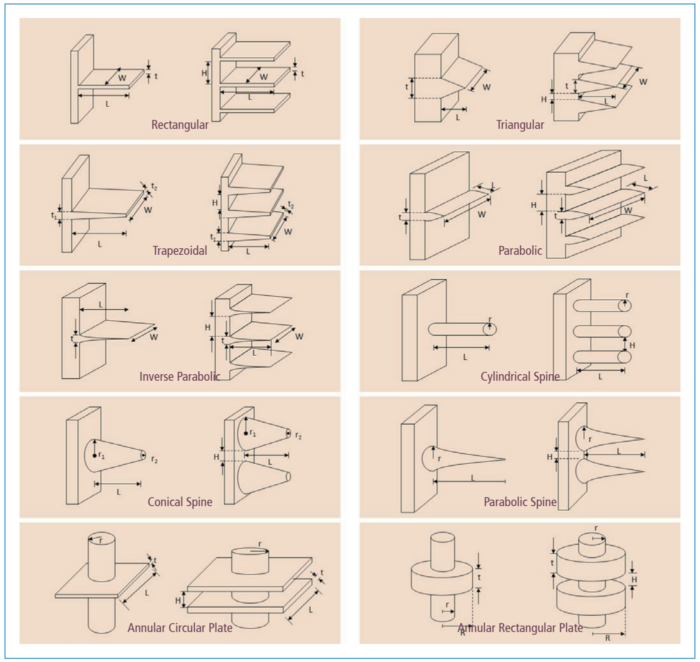
Fin/Fin Array Analysis



Features

- Single Fin and Fin Arrays.
- Calculation of Heat Flow Rate, Finned area, Fin Resistance, Single Fin Efficiency, Finned Surface Efficiency

Supported Fins & Fin Arrays



Microsoft Excel Output of Results

Design #	Description (for example, flow arrangement, multipassing, single/two phase flow etc.)	HX Problem Statement										
		Performance Requirement			Operating Conditions -Hot				Operating Conditions -Cold			
		Q	Δp-hot	Δp-cold	Fluid Type	Flow Rate	Tin	Pin	Fluid Type	Flow Rate	Tin	Pin
		[kW]	[kPa]	[kPa]	[-]	[lb/s]	[°F]	[psi]	[-]	[lb/s]	[°F]	[psi]
1	Cross-flow, single banking					55.997	860	0		55.116	572.02	0

HX Problem Statement						HX Size, Weight and Performance- Output					
HX Core Design Input						HX Core Dimensions					
t-sp	t-ep	w-sb-hot	h-sb-hot	w-sb-cold	h-sb-cold	P-L	P-W	L-NF/S	Np-h	Np-c	W
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[-]	[-]	[lb]
0.012	0.012	0	0.224	0	0.224	35.43	70.9	70.9	150	150	2510

HX Size, Weight and Performance- Output								
Hot Side								
Type	N-Fin or Channel	H (Plate Spacing)	t-fin	l or λ	2a	dh	Ac	A
[-]	[1/in]	[in]	[in]	[in]	[in]	[in]	[in²]	[in²]
rectangular/plain	12.7	0.224	0.006			0.109	2148	376650

HX Size, Weight and Performance- Output								
Cold Side								
Type	N-Fin or Channel	H (Plate Spacing)	t	l or λ	2a	dh	Ac	A
[-]	[1/in]	[in]	[in]	[in]	[in]	[in]	[in²]	[in²]
rectangular/plain	12.7	0.224	0.006			0.109	1074	376650

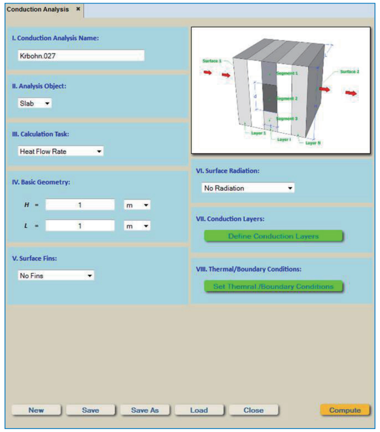
HX Size, Weight and Performance- Output										
Cold Side										
Tout	T_{mean}	Δp	σΔP	P_{mean}	μ_{mean}	$C_{p\text{-}mean}$	$K_{p\text{-}mean}$	Re	Pr	Nu
[°F]	[°F]	[psi]	[kPa]	[lb/ft³]	[lb/(ft*s)]	[Btu/(lb*°F)]	[btu/(h*ft*°F)]	[-]	[-]	[-]
784.1	621.5	0.627		0.3034	0.0000215	0.253	0.029	3128	0.678	11.55

HX Size, Weight and Performance- Output									
Cold Side		Overall HX Core Performance							
ηhA	P	EB	C*	ε	Q	NTU	UA	COP
[btu/(h*°F)]	[Btu/h]	[%]	[-]	[-]	[Btu/h]	[-]	[btu/(h*°F)]	[-]
542442.6	75844		0.984	0.736	10654794.2	4.282	215110.8	9.05088

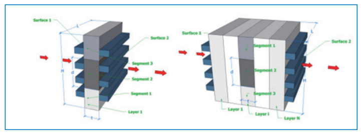
Heat Conduction Analysis

Features

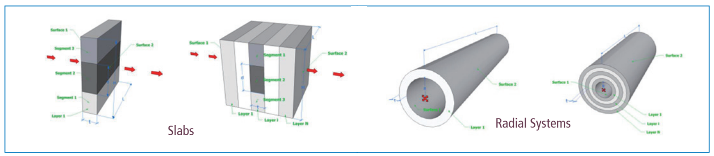
- Calculation of Total Heat Flow Rate, Thermal Resistance, Net Temperature Difference, Critical Radius (for Radial Walls only), and Thickness of a Layer



Support for finned surfaces



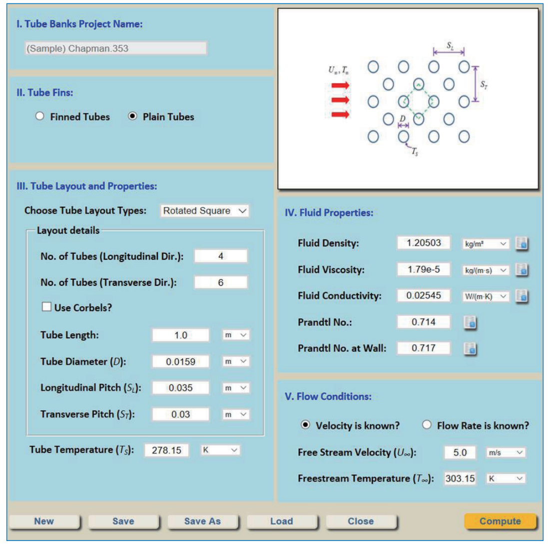
Support for the following systems

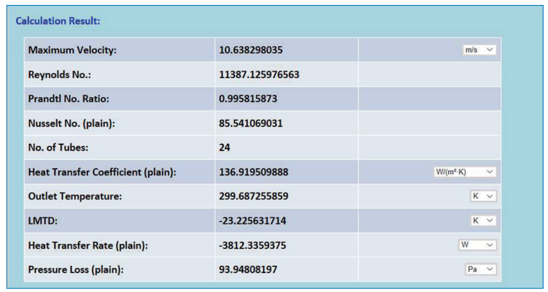


Tube Banks

Features

- Plain Tubes or Finned Tubes
- Calculation of Pressure Drop, Reynolds Number, Heat Transfer Rates for Tube Banks

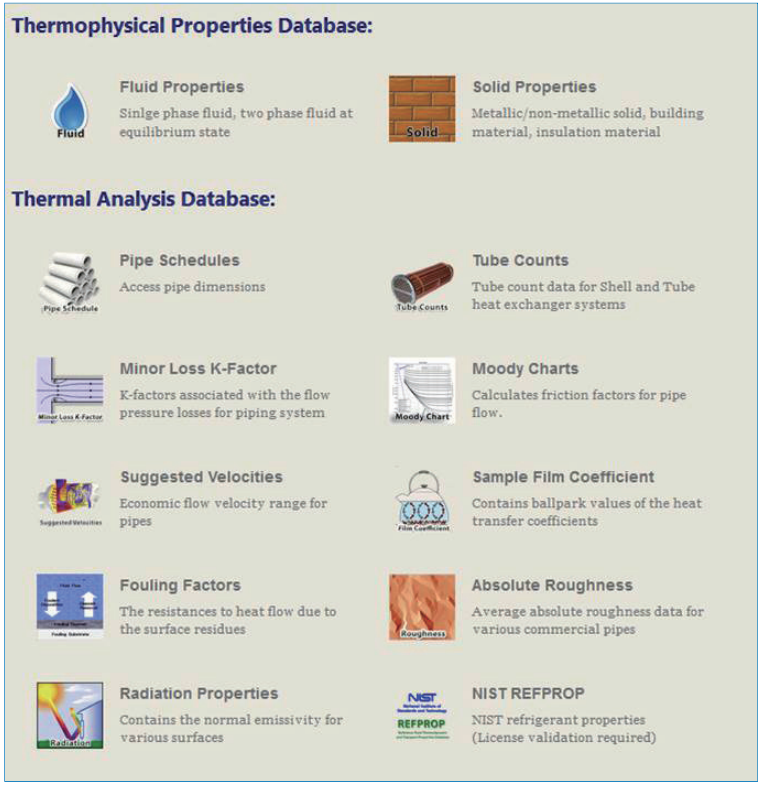




Calculation Result:

Maximum Velocity:	10.638298035	m/s
Reynolds No.:	11387.125976563	
Prandtl No. Ratio:	0.995815873	
Nusselt No. (plain):	85.541069031	
No. of Tubes:	24	
Heat Transfer Coefficient (plain):	136.919509888	W/(m²·K)
Outlet Temperature:	299.687255859	K
LMTD:	-23.225631714	K
Heat Transfer Rate (plain):	-3812.3359375	W
Pressure Loss (plain):	93.94808197	Pa

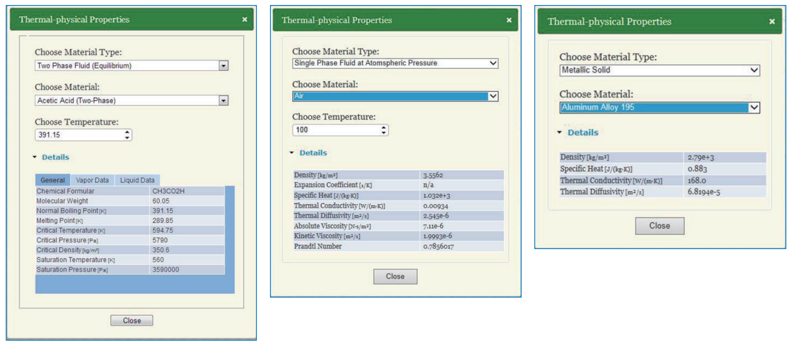
INSTED Database



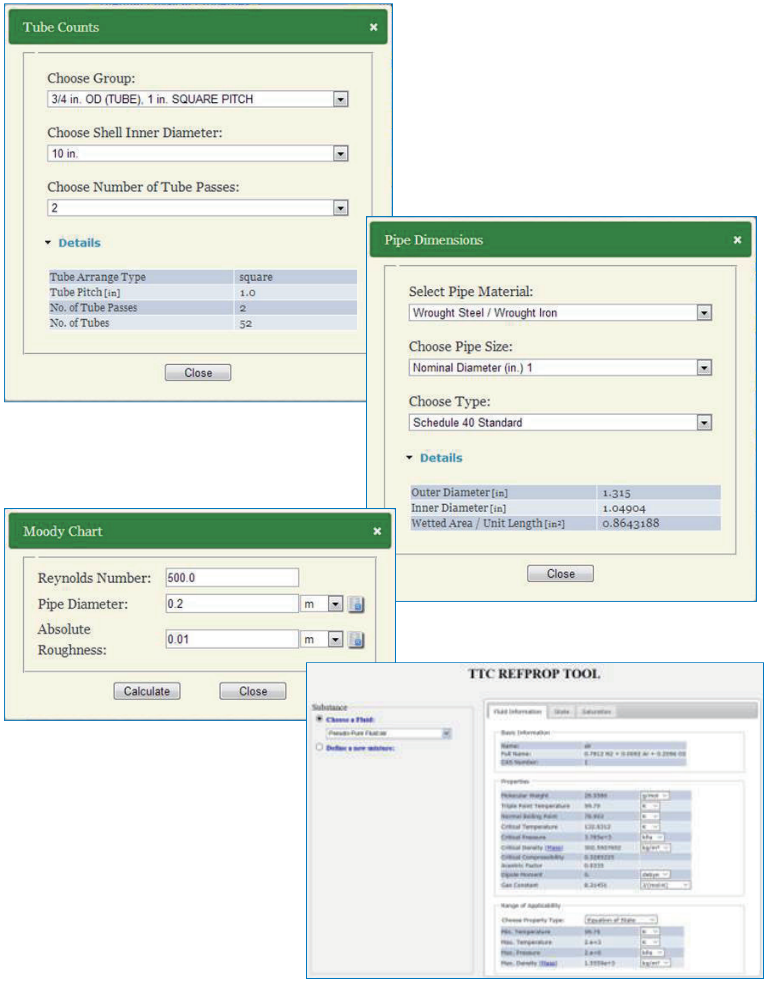
INSTED Database

Features

- Includes the Following Data and More;
  - Thermophysical properties of fluids and solids
  - Pipe schedules
  - Suggested velocities for the flow various fluids
  - Minor loss k-factors
  - Fouling factors
  - Absolute roughness
  - Sample film coefficients
  - Tube counts in Shell-and-Tubes
  - Moody charts (friction factor calculation)
  - Radiation properties
  - NIST's REFPROP
- Database is Integrated Throughout INSTED
- A standalone Version of the Database tool is also Available on Apple Store and Google Play

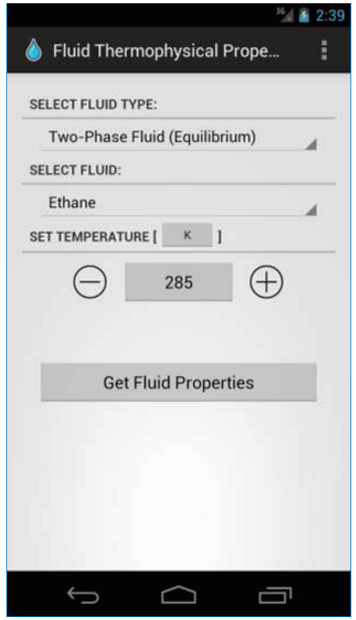


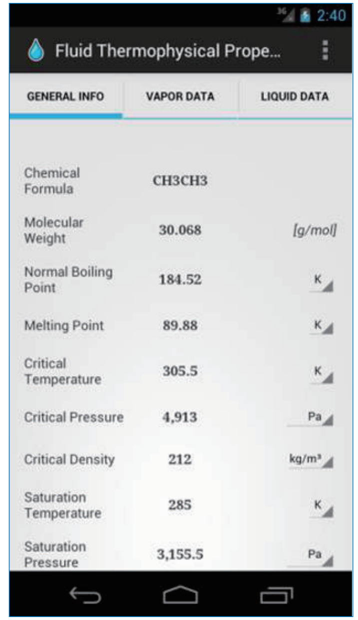
INSTED Database



Mobile App for Thermal-Hydraulic Database

Android Version



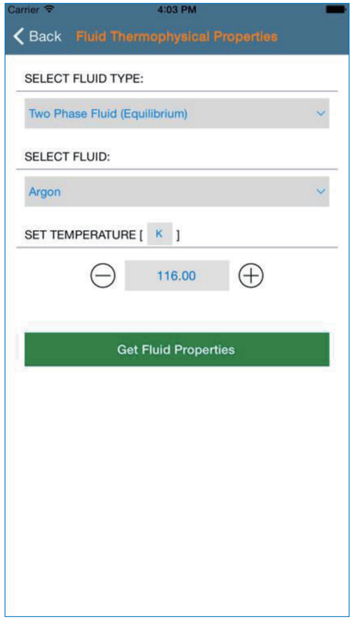


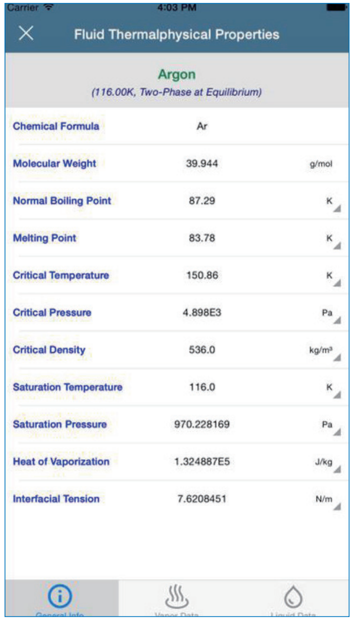
Say ‘Thermal-Hydraulic Database’ at Google Play
Google Play to launch app

Mobile App for Thermal-Hydraulic Database

iOS Version

Download on the App Store



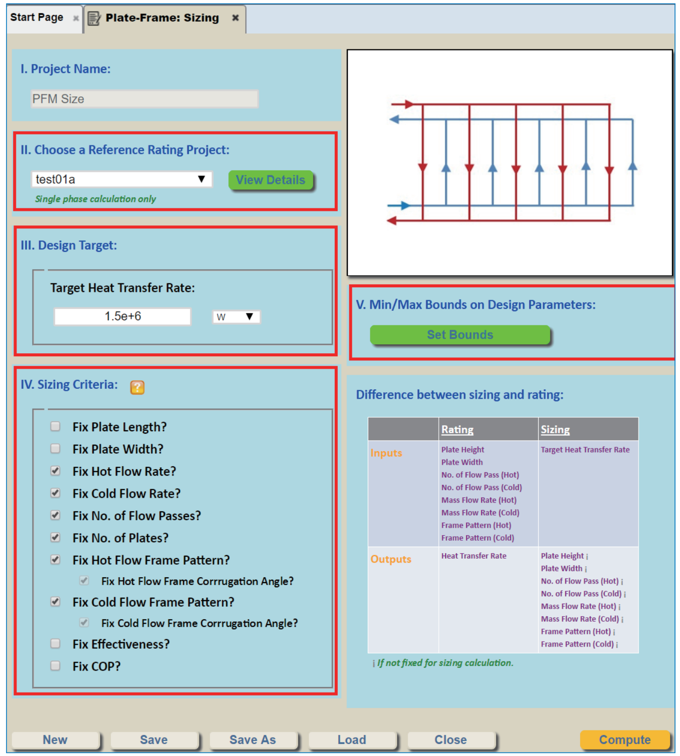


Ask Siri for 'Thermal-Hydraulic Database'

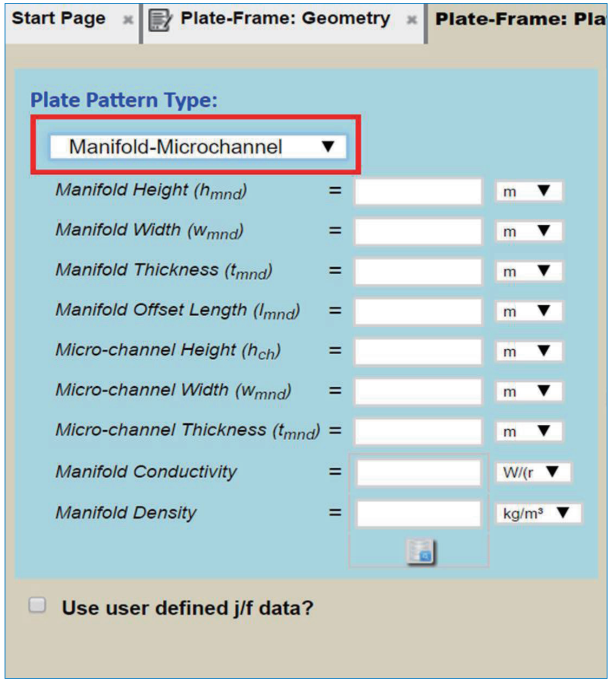
PLATE – FRAME MODULE

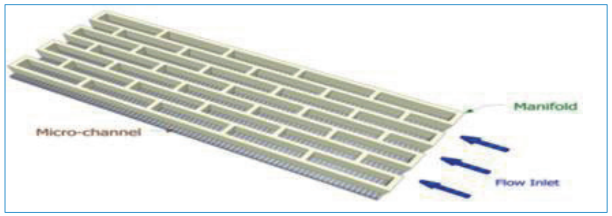
Features

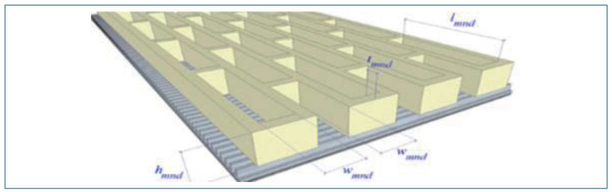
- Performance Analysis
- Parametric Rating Calculations
- Sizing & Optimization
- Custom j/f Data Input for Fins
- User-Defined Fin Geometry Data



MANIFOLDS-MICROCHANNELS





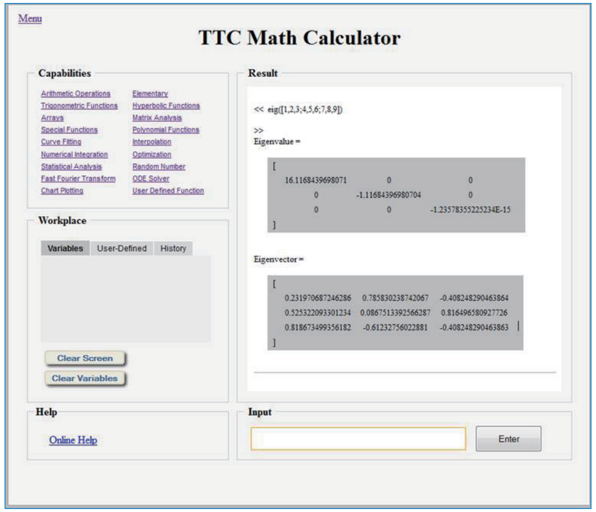


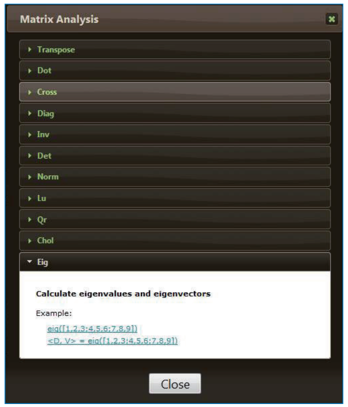
Two-Phase Models

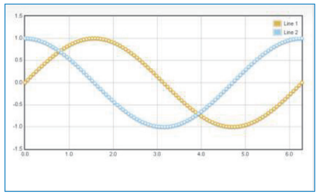
20 Condensation Models

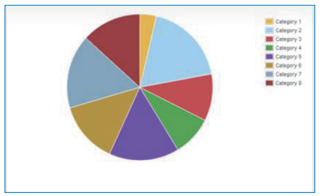
17 Boiling Models

TTC Engineering Tools









Sample TTC's Customers

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GE Power Systems

Lockhart Industries

Ametek Hughes-Treitler

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Champ Products

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UTC

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