CHAM Product Update

PHOENICS – Your Gateway to CFD Success

PHOENICS Direct 2014

HeatEx SimScene

Heat Exchanger Simulation

PHOENICS-Direct is a low-cost, simplified user interface for CHAM's PHOENICS CFD software package. PHOENICS-Direct, embodied within its application-specific SimScene, leads the user directly to just the capabilities required. (For a more-detailed description see: www.cham.co.uk/phoenics/d_sapps/Common/docs/PDSCNRIO.HTM#1.1)

CHAM has developed an easy-to-operate CFD-based simulator, called **HeatEx**, for shell-and-tube heat exchangers. It embodies the best available computer models of all the features which conventional industry-standard design packages either ignore or guess, including:

- ◊ realistic flow patterns within baffled tube banks and headers;
- ◊ non-uniformity of tube-and shell-side heat-transfer and pressure-drop coefficients;
- ◊ temperature dependence of fluid properties; and
- ◊ start-up and shut-down behaviour.

HeatEx can handle all the usual TEMA flow configurations, with arbitrary numbers and shapes of baffles, number of tube-side passes, and so forth. It predicts not only overall effectiveness and pumping-power requirements, but also reveals the internal flow distributions, locations of maximum tendency to tube vibration, low-velocity locations where deposits may occur, etc. Indeed all the things which operators truly want to know, but about which the industry-standard packages are silent.

The **HeatEx** SimScene simulates the thermal performance of three-dimensional shell and tube heat exchangers. It provides a pragmatic aid for designers and manufacturers to develop more-efficient and cost-effective heat exchangers.

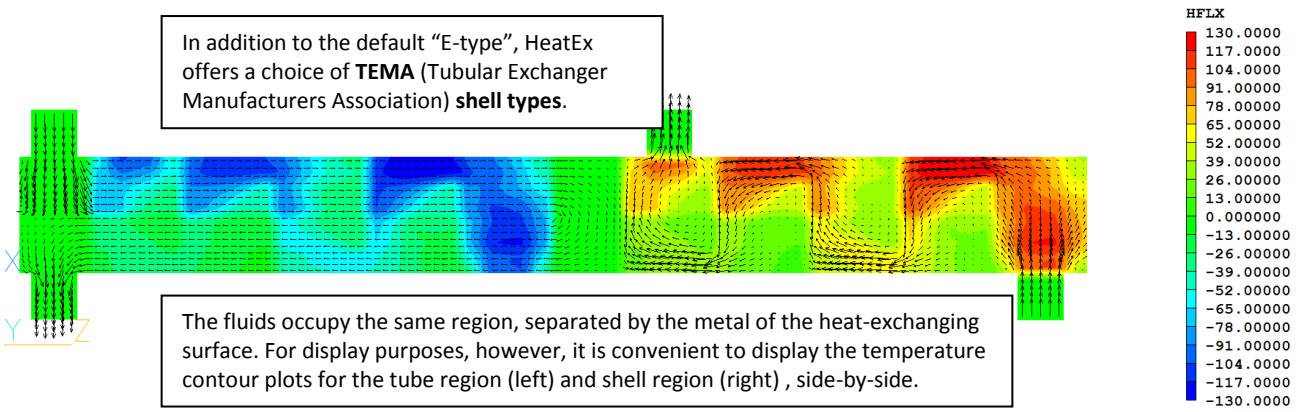
The use of CFD enables the designer to overcome most of the limitations of the manual and numerical methods currently used to rate heat exchanger performance, by removing some of the simplifying assumptions which such methods are forced to make, such as:

- uniformity of fluid properties;
- uniformity of heat-transfer coefficient; and
- independence of time.

Manual techniques such as 'stream-analysis' used for predicting steady-state thermal performance remain inappropriate for determining locations of:

- high velocity (likely to cause tube vibrations);
- low velocity (where deposition of solids may occur);
- deviations (from presumed-uniform heat-transfer coefficients); or
- time-dependent effects.

In addition to the default "E-type", HeatEx offers a choice of **TEMA** (Tubular Exchanger Manufacturers Association) **shell types**.



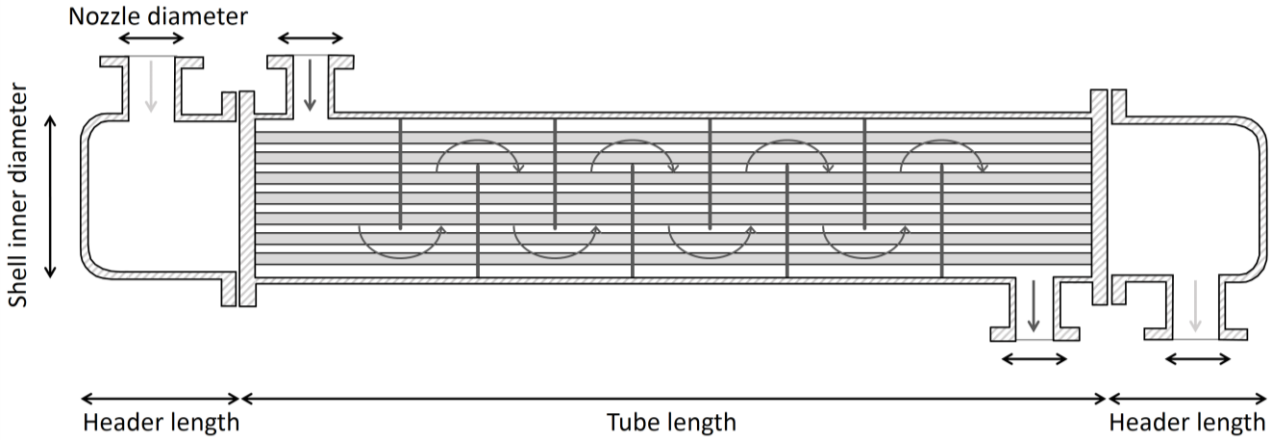
The fluids occupy the same region, separated by the metal of the heat-exchanging surface. For display purposes, however, it is convenient to display the temperature contour plots for the tube region (left) and shell region (right) , side-by-side.

Given sufficient computational resources, other mainstream CFD codes - like PHOENICS - can be used to simulate the 3D flows with variable fluid properties, using a detailed fine-grid CFD model of flows between and inside the tubes. The **HeatEx** SimScene, however, employs a "space-averaged" (SA) CFD technique sufficiently economical to be used in everyday design on portable computers. **HeatEx** enables the heat-transfer behaviour of the entire heat exchanger to be predicted swiftly and accurately, whilst avoiding the modelling presumptions of manual predictions.

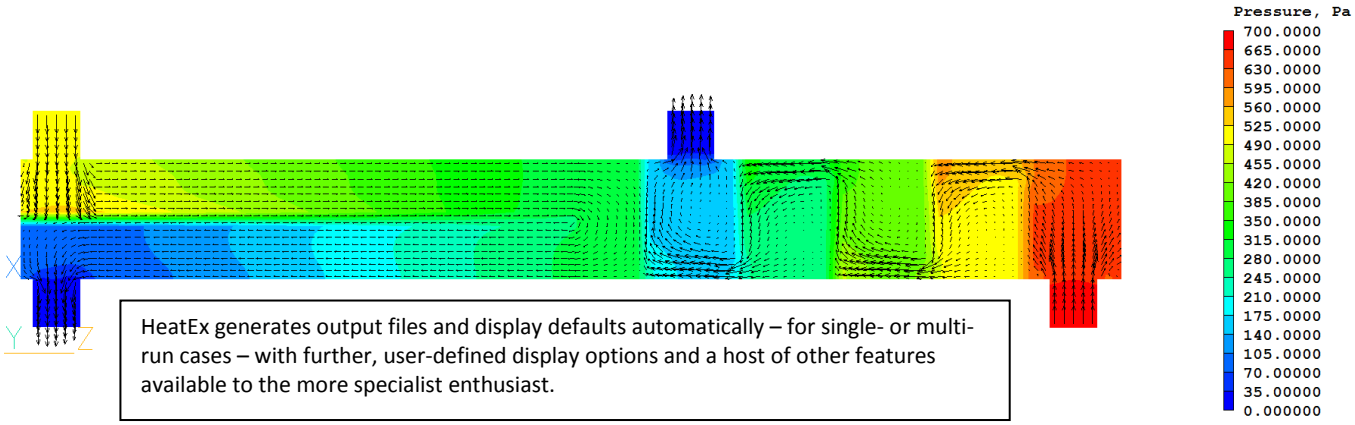
User inputs

The user is offered a series of drop-down menus from which to select from options and enter data, including:

- Flow configuration [eg concurrent or counter-concurrent flow options]
- Geometry options [eg user-defined or TEMA selection]



- Impingement plate options
- Tube pass type [eg type, number, size and layout of tubes]
- Baffle type [eg type, number, size and layout of internal baffles]
- Material properties [eg physical properties, thermal resistances] for tube-side and shell-side fluids
- Initial conditions [especially for time-dependent scenarios]
- Boundary conditions [flow rates, temperature, density, pressure, etc]
- Gravity [orientation]
- Output [display options]
- Steady-state / Transient options
- Numerical settings



HeatEx generates output files and display defaults automatically – for single- or multi-run cases – with further, user-defined display options and a host of other features available to the more specialist enthusiast.

The HeatEx SimScene operates on standard PC equipment. Contact Sales@cham.co.uk for the full range of available licensing options.

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