Numerical and experimental investigations of transient behaviour of compact plate fin heat exchanger
Abhilash Chakravarty, M Goyal, A Chakravarty and V Joemon
Bhabha Atomic Research Centre, Mumbai, India

Motivation:
Transient analysis helps to understand the dynamics of the plant and build control logic.

Problem statement:
A two stream, two layer PFHE with offset strip fins is to be analyzed for situations such as cool down, warm up and planned abrupt changes in inlet fluid temperatures.

Methodology:
• Discretization of heat exchanger along its length.
• Two models: Constant fluid(helium) properties and variable fluid properties.
• Assumptions: Axial heat conduction in metal, no heat exchange from surroundings and negligible pressure drops in streams.
• Governing equations: mass and energy conservation
• Output: Temperature at each node

Simulations:
• Validation with steady state published data.
• Effect of step and ramp changes in hot fluid inlet temperature.

Conclusions:
• The constant property model was validated with above experiment.
• As far as room temperature conditions are concerned, this model is good enough to represent the transient behaviour.
• Utility of variable properties model can be judged through experiments conducted at liquid nitrogen or liquid helium temperatures.
• Model improvement in terms of equation structuring and solution techniques has to be looked into.