Object-Oriented Library of Switching Moving Boundary Models for Two-phase Flow Evaporators and Condensers

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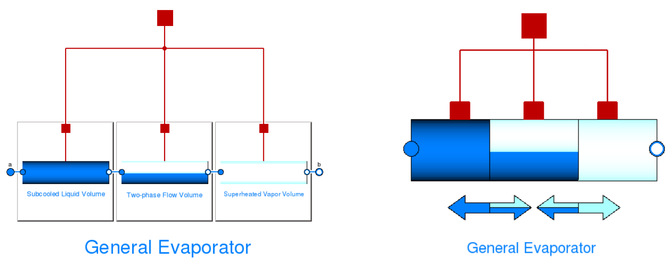
Heat exchangers play a very important role in industry; the modeling and control of these elements is a key part in the process plant control. Dynamic modeling is always a challenging task in which the trade-off between accuracy and speed must be evaluated. Moving Boundary Models (MBMs) are low-order and faster models than finite volume models; additionally they can describe the dynamic behavior of evaporators and condensers with high accuracy [1]. In the context of real-time simulation, dynamic system optimization and model-based control, where fast computation is required, the moving boundary method seems to be appropriate. The moving boundary method divides the evaporator/condenser in different regions depending on the fluid phase (subcooled liquid (SC), two-phase flow (TP) and superheated vapor (SH)). In each region, the lumped thermodynamic properties are averaged; the barrier is not fixed and it may move between adjacent CVs.



(a) Component diagram (b) Icon

Figure 1: General evaporator component

This paper discusses a new Modelica library of switching MBMs for two-phase flow heat exchangers, called the MBMs library. The novelty in this library is that the implementation strictly follows an object-oriented approach, because basic models considers the mass and energy balance equation, and compound models are developed interconnecting the basic models and adding switching support. All the evaporators and condensers are developed reusing the three basic models: SC, TP and SH models (cf. Fig. 1). An integrity test which compared the MBM results with the finite volume model implemented in the Modelica Fluid library as well as a stability test of the switching criteria are also presented.

References

[1] S. Bendapudi, J. Braun, and E. Groll. A comparison of moving-boundary and finite-volume formulations for transients in centrifugal chillers. *International*

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