Modeling of a falling film evaporator

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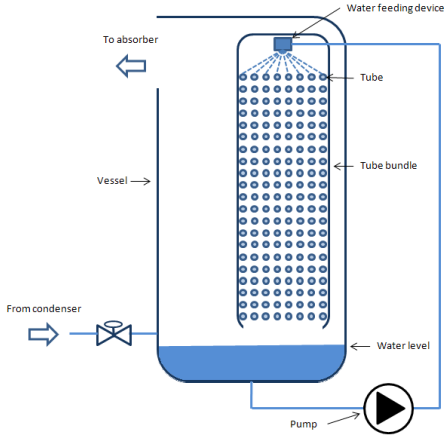
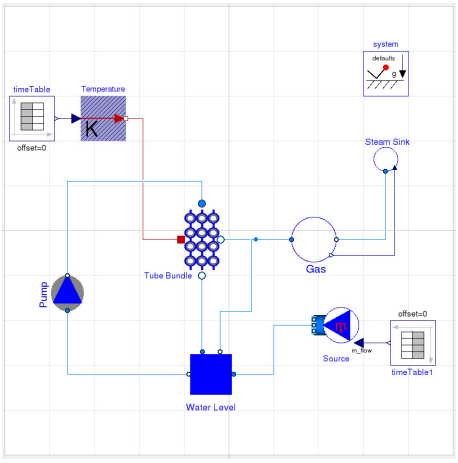
One of the difficulties of working with solar energy is its variability. Since this technology starts, researchers have studied how to avoid solar irradiance disturbances affect energy production. The proposed solutions range from thermal storage to auxiliary energy sources to make feasible facilities. At Plataforma Solar de Almería an experimental plant was set up to test and develop an hybrid solar-gas process that combines, a thermal desalination system and a solar field with a Double Effect Absorption Heat Pump (DEAHP) coupled with a gas boiler [1]. The DEAHP transfers heat from the last effect of the distillation plant (low temperature source) to the first effect (high temperature source) using the energy provided by the gas boiler.

This paper is focus on the evaporator of the DEATH. It is a horizontal-tubes-falling-film-type evaporator (a). Falling film evaporators have demonstrated better performance than flooded tubes evaporators in air conditioning and refrigeration applications due to its higher heat transfer coefficient and its smaller size [2].

The model presented in this paper is based on classical Newton's viscosity law and Nusselt falling film theory. A library of evaporator components compatible with Modelica.Fluid, Modelica.Thermal and Modelica.Media has been implemented (b). The simulations presented have the expected behaviour. These models will be used to a complete model of a heat pump.



(a) DEAHP evaporator scheme



(b) DEAHP evaporator in Modelica

References

[1] D. C. Alarcón-Padilla, L. García-Rodríguez, and J. Blanco-Gálvez. Experimental assessment of connection of an absorption heat pump to a multi-effect distillation unit. *Desalination*, 250(2):500–505, 2010.

[2] G. Ribatski and A. M. Jacobi. Falling-film evaporation on horizontal tubes—a critical review. *International Journal of Refrigeration*, 28(5):635–653, 2005.