Dynamic modeling and simulation of a multi-effect distillation plant

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Desalination processes provide an excellent way to tackle the water scarcity in places close to the sea. The use of desalination plants in these regions with plentiful seawater resources is becoming a technological way to produce freshwater. Since large-scale desalination typically requires large amounts of energy, a solution is coupling desalination plants with renewable energies [1]. This process can be performed in various ways, for instance, using solar energy in which the source that provides the heat for the desalination process is collected in a solar field.

Multi-effect distillation plants (MED) show a great interest in industry due to its efficiency when they are coupled with a solar thermal system. This kind of systems is gaining more acceptance as a result of their lower energy requirements, higher heat transfer coefficients, compactness, high product water quality and low pre-treatment [2].

The present paper shows a dynamic model for the multi-effect distillation unit included in the AQUASOL system [3] at CIEMAT-Plataforma Solar de Almería (PSA). This model has been developed with the object-oriented Modelica language using the Dymola tool and the *Modelica.Thermal* library. This framework has allowed us to develop new libraries to make simulations easier in different operating conditions. It has been designed to improve the operation of the process and develop a control strategy which optimizes the distillate production. The physical models are based on conservation equations of mass and energy. They also include experimental correlations for heat transfer coefficients [4]. Conservation laws are applied in the different components such as the heater, the effects and the preheaters. The results of the mathematical model simulation of the whole process show promising outcomes.

References

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