Superheat Control with a Dynamic Inverse Model

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Superheat control has influence on the coefficient of performance (COP), the stability and the compressor endurance of a vapor compression cycle. It is a challenging task since the system dynamics of a refrigeration cycle are highly nonlinear and the control targets can be contrary. In an increasing number of applications electronic expansion valves (EXV) are used. With EXVs superheat and thus stability and COP can be controlled directly in contrast to thermostatic expansion valves (TXV) or orifice valves. New control approaches can benefit from this additional degree of freedom.

It raises the question if simulation models can be used for feedforward control to fulfill this function. For building a feedforward control structure a simulation model needs to be inverted. In this paper a dynamic, continuous submodel of a refrigeration cycle, consisting of models for expansion valve and evaporator, is inverted. The resulting controller is tested in a model-in-the-loop environment and applied on an automotive refrigeration cycle. The advantage of a dynamic inverse model in contrast to a static one is pointed out. Also the results are compared to a standard PI controller.

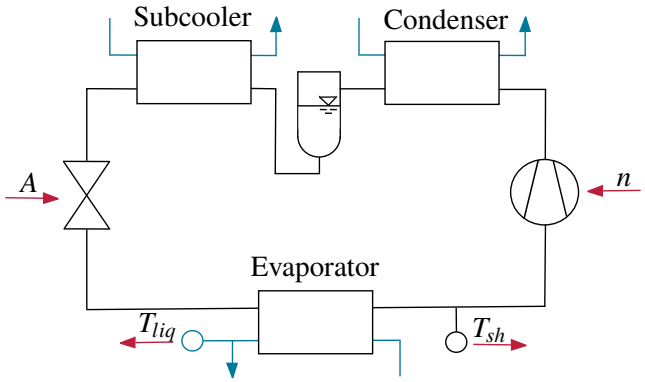

Figure 1: Modelled Refrigeration Cycle