

Multivariable Control of Vapor Compression Refrigeration Systems. Part II: Controller Design

Leonardo C. Schurt

Department of Automation and Control, Federal University of Santa Catarina, Florianopolis, SC, Brazil

Christian J. L. Hermes^{C, S}

National Institute of Science and Technology in Refrigeration and Thermophysics, Federal University of Santa Catarina, Florianopolis, SC, Brazil

Alexandre Trofino Neto

Department of Automation and Control, Federal University of Santa Catarina, Florianopolis, SC, Brazil

This paper introduces a multivariate linear control strategy acting simultaneously on the compressor speed and on the electric expansion valve opening for controlling the evaporator feeding and also for matching the cooling capacity to the thermal loads. Firstly, the dynamic simulation model developed and validated in the first part of the study was linearized according to a Taylor expansion series and then used to design the controller based on the linear-quadratic Gaussian (LQG) scheme using a Kalman filter for the estimator design. Experimental tests were also carried out in order to verify the controller ability of tracking a reference change and also of rejecting thermal load disturbances as high as 15 %. In all cases, it has been found that the controller performed satisfactorily well not only for reference tracking but also for disturbance rejection.