Title Uncertainty analysis of a storage facility under optimal control

Author T.G. Doeswijk, K.J. Keesman and G. van Straten

Citation Biosystems Engineering, Volume 99, Issue 1, January 2008, Pages 67-75

Keywords nonlinear model; storage facility

Abstract

Model reduction, linearisation and discretisation are standard techniques in systems theory to simplify nonlinear models. In this paper, these techniques are used on a nonlinear model of a storage facility with forced ventilation with ambient air. Consequently, weather forecasts are needed to predict the systems' trajectory. Because weather forecasts inherit uncertainty, the storage model is amenable to uncertainty. Based on a linearised version of the storage model, standard error propagation rules have been used to predict the system uncertainty analytically.

Optimal control calculates controls in such a way that a prespecified cost criterion is minimised. As the uncertainty of the storage system is subject to ventilation with outside air, uncertainty of the model state increases with increased ventilation. The model uncertainty is integrated into the cost criterion to allow a trade-off between an optimal nominal solution and a minimum variance control solution. In this respect, the predicted 95% confidence limits are kept as close as possible to the reference trajectory.