A Simplified Approach to Multivariable Model Predictive Control

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Abstract

The benefits of applying the range of technologies generally known as Model Predictive Control (MPC) to the control of industrial processes have been well documented in recent years. One of the principal drawbacks to MPC schemes are the relatively high on-line computational burdens when used with adaptive, constrained and/or multivariable processes, which has warranted some researchers and practitioners to seek simplified approaches for its implementation. To date, several schemes have been proposed based around a simplified 1-norm formulation of multivariable MPC, which is solved online using the simplex algorithm in both the unconstrained and constrained cases. In this paper a 2-norm approach to simplified multivariable MPC is formulated, which is solved online using a vector-matrix product or a simple iterative coordinate descent algorithm for the unconstrained and constrained cases respectively. A CARIMA model is employed to ensure offset-free control, and a simple scheme to produce the optimal predictions is described. A small simulation study and further discussions help to illustrate that this quadratic formulation performs well and can be considered a useful adjunct to its linear counterpart, and still retains the beneficial features such as ease of computer-based implementation.

Keywords: Real-time and embedded control, predictive control, multivariable control.

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