Abstract

On the computation and parametrization of proper denominator assigning compensators for strictly proper plants

A.I.G. Vardulakis
Department of Mathematics
Aristotle University of Thessaloniki
54006 - Thessaloniki - GREECE
Tel: +30 2310 997951 - Fax: +30 2310 997951
E-mail: avardula@math.auth.gr

I consider linear, time invariant, multivariable systems which are assumed to be free of unstable hidden modes and whose input-output relation is described by a strictly proper transfer function matrix $P(s)$ (the plant). In this seminar I will describe a numerically efficient algorithm for the computation of the class of proper compensators $C(s)$ which, when employed in the unity feedback loop of figure 0.1, give rise to a closed loop system $S(P,C)$ with a specific closed loop denominator $D_C(s)$ [6], [8]. In particular, given a right coprime MFD of a strictly proper plant $P(s) = N_R(s) D_R(s)^{-1}$ with $D_R(s)$ column reduced and an appropriately defined polynomial matrix $D_C(s)$ with desired zeros, we extend the Wolovich [1] resultant theorem and a theorem by Callier and Desoer [13], Callier [14] and Kucera [9] in order to obtain an algorithm for the computation of all polynomial solutions $[X_L(s), Y_L(s)]$ of the polynomial matrix Diophantine equation

$$X_L(s) D_R(s) + Y_L(s) N_R(s) = D_C(s)$$ (0.1)

which give rise to the class $\Phi(P, D_C)$ of proper compensators $C(s) := X_L(s)^{-1} Y_L(s)$ that result to closed loop systems $S(P, C)$ with $D_C(s)$ as their closed-loop denominator. The issues of the parametrization of the proper compensators $C(s) \in \Phi(P, D_C)$ and the number of independent parameters in the parametrization is also resolved.
This is done by investigating the properties of a generalized version of Wolovich’s resultant to obtain a series of new results regarding its algebraic structure. Despite the fact that similar results for Sylvester-type resultants have been presented in [3], the Wolovich resultant has not received the expected attention, except perhaps [1] and [2] where Wolovich’s resultant is used as a tool for testing the coprimeness of polynomial matrices.

References


