THE CONTROL OF MULTIVARIABLE TIME-DELAYED PROCESSES AND A GENERALIZED SMITH PREDICTOR

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Abstract

In this thesis the description, analysis and control of time-delayed multivariable processes are investigated, particularly the descriptions of multivariable processes that facilitate a multivariable extension of the Smith predictor.

Two new pseudo-commutativity results for matrix multiplication are presented. These results are used to show that a general time-delayed transfer function can be decomposed into three components representing input-delays, output-delays and the delay-free dynamics of the process. It is also shown that any such time-delayed transfer function can also be written in a form in which all the delays appear as output-delays.

These time-delayed transfer functions are used in the development of a multivariable Smith predictor.

It is also shown that the pseudo-commutativity results can be applied to non-delayed processes. In particular a new method, based on these results, for reformulating a transfer function description of a process as a state-space description is developed.

A case study of a time-delayed process is investigated.

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