

Regulator Design for Multidimensional Objects of the Second Order with Delay by Numerical Optimization

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Abstract: Designing regulators for single-channel systems in the twenty-first century is no longer a difficult problem. Existing methods for their calculation by numerical optimization make it possible to relatively easily solve a substantial part of the problems, the solution of which was previously devoted to a lot of scientific articles, textbooks, monographs. Some of these tasks remained unsolved, which is associated with the specific features of the object models. Objects with many inputs and many outputs, called multichannel or multidimensional, and in the English language literature MIMO - Many Inputs Many Outputs - still pose a certain problem. Such problems are also solved in some cases by numerical optimization, but a systematic presentation of the methods for solving this problem is not enough in the literature. This article attempts to systematize the methodology for solving this problem with one example, which is of sufficient complexity due to the fact that in the matrix transfer function of the object, each element is a second-order link with a delay element. The application of the method of numerical optimization directly, without any preliminary analytical actions, did not lead to the desired result, therefore, some special methods were used, which are recommended for solving such problems.

Key words: mathematical modeling, regulators, controllers, PID, multichannel systems, MIMO, stability, accuracy, control in technical systems, automation, cybernetics, numerical simulation, optimization

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