

Eigenstructure Assignment by Proportional-plus-derivative Feedback for Second-order Linear Control Systems

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Abstract: (Principle technique and conclusions). This paper introduces a complete parametric approach for solving the eigenstructure assignment problem using proportional-plus-derivative feedback for second-order linear control systems. In this work, necessary and sufficient conditions that ensure the solvability for the second-order system are derived. A parametric solution to the feedback gain matrix is introduced that describes the available degrees of freedom offered by the proportional-plus-derivative feedback in selecting the associated eigenvectors from an admissible class. These freedoms can be utilized to improve robustness of the closed-loop system. The main advantage of the described approach is that the problem is tackled directly in the second-order form without transformation into the first-order form and without mass matrix inversion and the computation is numerically stable as it uses only the singular value decomposition and simple matrix transformation. Numerical examples are included to show the effectiveness of the proposed approach.

Keywords: eigenstructure assignment; second-order systems; proportional-plus-derivative feedback; feedback stabilization; parameterization;

AMS Subject Classification: