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Comparative analysis of controller tuning methods for second-order time delayed object model with astatism

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Abstract

This paper presents a comparative analysis of the tuning procedures of the control algorithms for a second-order time delayed control object model with astatism with known parameters using the methods of maximal stability degree with iterations and polynomial approach. For tuning the controller parameters for the second-order time delayed control object model with astatism with known parameters, a procedure using the maximal stability degree method with iterations is developed. Analytical expressions for the controller tuning parameters are obtained as nonlinear functions of the stability degree argument and the known object parameters. The stability degree is varied, and these functions are graphically constructed. Through iterative procedures along these curves, sets of controller parameter values are selected for the same argument value. Performance analysis and system robustness are established through simulation, aiming to achieve the highest results. A control algorithm synthesis procedure is developed using the modified polynomial method. To verify and compare the obtained results, an example is studied based on the proposed methods. The application of pole-zero method and parametric optimization are performed, and system simulations are conducted on a computer to analyze performance. The control object model parameters are varied within ±50 % of the nominal values, and system robustness is verified. The advantages of the maximal stability degree method with reduced calculations and minimal time and the modified polynomial method are highlighted, simplifying the controller parameter tuning process for these object models.

Keywords: *automatic system, control algorithm, controller tuning, robustness, system performance, system response, transfer function, tuning*

methods, tuning parameters

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