

Tool for Analysing the Sensitivity and Tolerance of Mechatronic Systems in Matlab GUI

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Abstract : The article deals with the tool in Matlab GUI form that is designed to analyse a mechatronic system sensitivity and tolerance. In the analysed mechatronic system, a torque is transferred from the drive to the load through a coupling containing flexible elements. Different methods of control system design are used. The classic form of the feedback control is proposed using Naslin method, modulus optimum criterion and inverse dynamics method. The cascade form of the control is proposed based on combination of modulus optimum criterion and symmetric optimum criterion. The sensitivity is analysed on the basis of absolute and relative sensitivity of system function to the change of chosen parameter value of the mechatronic system, as well as the control subsystem. The tolerance is analysed in the form of determining the range of allowed relative changes of selected system parameters in the field of system stability. The tool allows to analyse an influence of torsion stiffness, torsion damping, inertia moments of the motor and the load and controller(s) parameters. The sensitivity and tolerance are monitored in terms of the impact of parameter change on the response in the form of system step response and system frequency-response logarithmic characteristics. The Symbolic Math Toolbox for expression of the final shape of analysed system functions was used. The sensitivity and tolerance are graphically represented as 2D graph of sensitivity or tolerance of the system function and 3D/2D static/interactive graph of step/frequency response.

Keywords : mechatronic systems, Matlab GUI, sensitivity, tolerance

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