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Pragmatic Design Methods Using Adaptive Controller Structures for Mechatronic Applications with Variable Parameters and Working Conditions

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Abstract

This chapter treats two pragmatic design methods for controllers dedicated to mechatronic applications working under variable conditions; for such applications adaptive structures of the control algorithms are of great interest. Basically, the design is based on two extensions of the modulus optimum method and of the symmetrical optimum method (SO-m): the Extended SO-m and the double parameterization of the SO-m (2p-SO-m). Both methods are introduced by the authors and they use PI(D) controllers that can ensure high control performance: increased value of the phase margins, improved tracking performance, and efficient disturbance rejection. A short and systematic presentation of the methods and digital implementation aspects using an adaptive structure of the algorithms for industrial applications are given. The application deals with a cascade speed control structure for a driving system with continuously variable parameters, i.e., electrical drives with variable

reference input, variable moment of inertia and variable disturbance input.

List of Abbreviations

SO-m	Symmetrical Optimum method
Mo-M	Modulus Optimum method
ESO-m	Extended Symmetrical Optimum method
2p-SO-m	Double parameterization of the SO-m
2-DOF	Two Degree of Freedom
VMI	Variable Moment of Inertia
t.f.	Transfer function
c.a.	Control algorithm
C-VR-MI-LD	Continuously Variable Reference, Moment of Inertia and Load Disturbance
DC-m, BLDC-m	DC-motors, Brush-Less DC-motors
MM	Mathematical Model
CS	Control Structure
CCS	Cascade Control Structure

"*The PID controller can be said to be 'the bread and the butter' of the control engineering*".

(K.-J. Åström)

Notes

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