Implementation of Robust Control Laws in Embedded Control Systems

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Biography:

Petko Petkov received M.S. and Ph.D. degrees in control engineering from the Technical University of Sofia in 1971 and 1979. Since 1973, he has been a faculty member in the Department of Systems and Control at the Technical University of Sofia. He has been a professor of control theory in the same department since 1995. His research interests include numerical methods for control systems analysis and design, robust control systems design, and development of algorithms and software for computer-aided control systems design. He coauthored Computational Methods for Linear Control Systems (Prentice Hall, Hemel Hempstead, U.K., 1991), Perturbation Theory for Matrix Equations (North-Holland, Amsterdam, 2003) and Robust Control Design with MATLAB® (Springer, London, 2005). Dr. Petkov is a corresponding member of the Bulgarian Academy of Sciences.

Abstract:

This talk is devoted to the new problems and challenges arising in the implementation of robust controllers in embedded systems. After an introduction of some basic definitions such as robust stability and robust performance, a brief review of the methods for robust control design is made. Advantages and disadvantages of H_∞-optimization and μ-synthesis methods are discussed and some conclusions concerning their practical implementation are derived. It is pointed out that the controller structure is not generated automatically by these methods and the designer has to choose between several opportunities. The widely used technology for developing embedded control systems based on MATLAB® and Simulink® software products is briefly presented. It is noted that the high level of the sensor noises in embedded systems may lead to actuators saturation and nonlinear effects in the closed-loop system dynamics. The design of discrete-time robust controllers of a two-rotor aerodynamic system and of a two-wheeled LEGO® robot is considered in details. Simulation and experimental results for both systems are given that confirm the possibility to use high order robust control laws in the real time control of uncertain plants.