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Preface

Special section on aerospace control

During the IFAC World Congress 2002 in Barcelona, a broad spectrum of challenging and inspiring control applications for aircraft and spacecraft have been presented in more than 40 contributions, addressing focal control areas such as Spacecraft Attitude Determination and Control, Aircraft Control, Robust and Fault-Tolerant Aerospace Control Systems, MIMO Design Approaches for Aerospace Applications, Unmanned Vehicle Control, Missile Guidance and Control. From this spectrum, five papers covering the broad range of control systems for launchers, spacecrafts, missiles, and helicopters have been selected for the present special section.

The section is introduced by a survey on aerospace control in the "Milestone report on aerospace control", compiled by the IFAC Technical Committee on Aerospace. It provides an overview on key control achievements in the area of aerospace and tries to predict future challenges and expected main trends for technology developments.

The contribution "Aerospace launch vehicle control: A gain scheduling approach" by B. Clement, G. Duc and S. Mauffrey addresses the autopilot design for a launcher during atmospheric flight. It presents the combination of various control theoretical tools to solve the launcher control problem, providing, in particular, stability against wind disturbances.

The on-board controller design for a typical attitude control configuration based on star sensor camera, four reaction wheels and magnetotorquers is analyzed in "Slew maneuver control for spacecraft equipped with star camera and reaction wheels" by R. Wisniewski and P. Kulczycki. This paper provides an elegant approach based on the energy shaping method for slew maneuver implementation avoiding sun exposure of the camera, and for optimum control torque distribution.

In the framework of small satellites, classical magnetic actuators again play a significant role for attitude control systems constraints by minimal use of resources. "Magnetic spacecraft attitude control: A survey and some new results" by E. Silani and M. Lovera provides a review of magnetic attitude control methods. They present a model-based predictive control approach to deal with the constraints resulting from the fact that control torques can only be generated in the plane orthogonal to the magnetic field vector.

Nonlinear control system design methods are analyzed for the autopilot design of missiles in "Adaptive flight control design for nonlinear missile" by A. Tsourdos and B.A. White. The adaptive control approach allows handling the highly nonlinear aerodynamics of typical missiles.

The adaptation of the H^{∞}-method from theory to simulation to successful flight test is addressed for the case of a helicopter in "Design and flight testing of various H^{∞} controllers for the Bell 205 helicopter" by I. Postlethwaite, E. Premain, E. Turkoglu, M.C. Turner, K. Ellis and A.W. Gubbels. The nonlinear, complex coupled dynamics of helicopters represent a challenging test case for controller designs. Here, in-flight tests and simulations provide the basis for comparisons of controller designs and their stability properties.

From the beginning, aerospace vehicles crucially depended on progress in guidance, navigation and control. These papers are an example that challenging aerospace problems continue to promote interesting control applications. Thus, I hope that not only will aerospace engineers enjoy reading these approaches but will profit from transferring similar control methods to their specific application fields.

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