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A Combined Reference Management and Anti-Windup Modification for Adaptive Airspeed Control of Hypersonic Vehicles under Input Constraints.

SPEAKER

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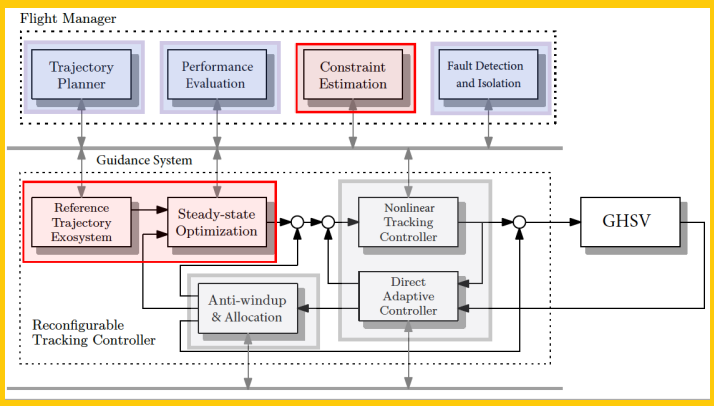
ABSTRACT

The topic of this talk is the incorporation of limits of operability of the scramjet engine within an adaptive guidance and flight control architecture for the 6DOF model of a generic hypersonic air-breathing vehicle. Lower bounds on the throttle setting arise from the necessity of maintaining a minimal fuel rate due to thermal management considerations, whereas upper bounds are determined from the necessity to avoiding thermal chocking of the engine. The proposed strategy employs a seamless integration between a dynamic reference management and a model-recovery anti-windup modification for an adaptive airspeed controller. In particular, a feasible input reference trajectory (which depends on the parameter estimates) is provided to the adaptive controller so that convergence to a feasible setpoint for the throttle setting is attained, while the anti-windup modification prevents the parameter update law to react abnormally to prolonged saturations.



ABOUT THE SPEAKER

Andrea Serrani received the Laurea (B.Eng.) degree in Electrical Engineering, summa cum laude, from the University of Ancona, Italy, in 1993, and the Ph.D. degree in Artificial Intelligence Systems from the same institution in 1997. From 1994 to 1999, he was a Fulbright Fellow at Washington University in St. Louis, MO, where he obtained the M.S. and D.Sc. degrees in Systems Science and Mathematics in 1996 and 2000, respectively. Since 2002, he has been with the Department of Electrical and Computer Engineering, where he is currently a Professor and Chair of Graduate Studies. He has held visiting positions at the University of Bologna and at the University of Padua, Italy, and multiple summer faculty positions at AFRL, including four AF-SFFP Fellowships.

The research activity of Prof. Serrani lies at the intersection of methodological aspects of nonlinear, adaptive and geometric control theory with advanced applications in aerospace and marine systems, fluidic systems, robotics and automotive engineering. Prof. Serrani has authored or co-authored more than 150 articles in journals, proceedings of international conferences and book chapters, and is the co-author of the book Robust Autonomous Guidance: An Internal Model Approach published by Springer-Verlag. Prof. Serrani is currently serving as Editor-in-Chief of the IEEE Tr. on Control Systems Technology and served in the past as Associate Editor for the same journal (2010 2016), Automatica (2008-2014) and the Int. Journal of Robust and Nonlinear Control (2006-2014). He serves on the Conference Editorial Boards of IEEE CSS and IFAC, and has served as Editor-at-Large for the 53rd and 51st IEEE CDC. He is the Program Chair for the 2019 ACC. He is a member of IEEE, IFAC and AIAA.

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