Nonlinear Tracking Control by Trajectory Linearization

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Abstract: In this talk we present a nonlinear output tracking control technique called trajectory linearization control (TLC). The TLC method is based on the notion of trajectory stabilization in the sense of Lyapunov, where a nominal control is applied in an open-loop fashion to put the system output in the vicinity of the commanded nominal trajectory, and a closed-loop tracking error regulator is designed to stabilize the time-varying tracking error dynamics by linearization along the nominal trajectory. The method is applicable to nonminimum phase nonlinear plants, and has distinct advantages over many other nonlinear control methods. A complete design of a TLC tracking controller and trajectory linearization observer (TLO) will be presented for an unstable, nonminimum phase, stiff nonlinear plant with fast tracking trajectories. The TLC method has been applied to the ascent and entry flight controller design for the X-33 Reusable Launch Vehicle with marked success, which will also be briefly discussed.

Biography: Dr. Zhu's is a Professor of the School of Electrical Engineering and Computer Science, Ohio University. His main research area and contribution is in time-varying linear systems theory and nonlinear control system design. To date he has published more than 90 papers in mathematical and engineering journals and conference proceedings. Since 1990 he has served as PI or Co-PI on sponsored research projects totaling more than $6M, including nearly $5M ongoing projects on flight control and closed-loop aerodynamic flow control. Dr. Zhu is a Senior Member of the IEEE, a Member of AIAA and AAS. He currently serves as the Associate Chair of the IEEE Control System Society (CSS) Conference Editorial Board, and an elected member of the CSS Board of Governors.