

Control of Nonlinear Systems Under Dynamic Constraints

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ABSTRACT

Most practical systems operate under certain constrained environment, making the control problem much more challenging as compared with the case free from constraint. In this talk, we focus on the problem of designing control schemes for constrained strict-feedback nonlinear systems. For such systems under full-state constraints, current barrier Lyapunov function (BLF) and integral BLF based control solutions rely on feasibility conditions for virtual controllers. Here we present a new solution that completely removes such restrictive conditions. First, we construct a nonlinear state-dependent function that purely depends on constrained states to cope with full state and asymmetric constraints directly; second, we introduce a new coordinate transformation and integrate it into each step of dynamic surface control based backstepping design, completely circumventing the demanding feasibility conditions on virtual controllers. Consequently, there is no need for the tedious offline computations for feasibility verification, allowing the designer more freedom to select design parameters, enabling the system with a larger range of initial conditions to be handled, and rendering the solution more user-friendly in design and implementation. Simulation verification also confirms the benefits and effectiveness of the proposed control method.

BIOGRAPHY

Prof Yong-Duan Song received his Ph.D. degree in electrical and computer engineering from Tennessee Technological University, Cookeville, USA in 1992. He held a tenured Full Professor position with North Carolina A&T State University, Greensboro, from 1993 to 2008 and a Langley Distinguished Professor position with the National Institute of Aerospace, Hampton, VA, from 2005 to 2008. He is now the Dean of School of Automation, Chongqing University, and the Founding Director of the Institute of Smart Systems, Chongqing University. His research interest covers biologically inspired control, artificial intelligent and robotic systems, and fault-tolerant control with applications. Prof. Song has received several competitive research awards from the National Science Foundation, the National Aeronautics and Space Administration, the Army Research Office, and the Office of Naval Research.

All are welcome!



In case of questions, please contact Prof K C Tan at Tel: 3442 8504, E-mail: kaytan@cityu.edu.hk, or visit the CS Departmental Seminar Web at <http://www.cs.cityu.edu.hk/>.

