Electric Power and Power Electronics Institute

WEEKLY SEMINAR SERIES – FALL 2016
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COORDINATE TRANSFORMATION AND FEEDBACK FOR LINEARIZATION OF AFFINE NONLINEAR SYSTEMS

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Abstract

Linear systems are relatively more mature, with many design and analysis tools available for use. Unfortunately, many systems in communication, networked systems, and other cyber-physical systems are nonlinear in nature. Stability, performance, and robustness of such systems are critically important. But the tools available for analyzing nonlinear systems are limited. Feedback linearization is one of the techniques that can be applied to some nonlinear systems.

An affine nonlinear system $\dot{x} = f(x) + g(x)u$ is said to be feedback linearizable if there exists a nonlinear coordinate transformation $z = T(x)$ and a feedback $u = \alpha(x) + \beta(x)v$ such that $\dot{z} = Ax + bv$, where (A, b) is controllable. Necessary and sufficient conditions for feedback linearization were derived in the early 80's. However, the construction of the coordinate transformation requires the solution to a set of partial differential equations. This greatly limits the application of the feedback linearization methodology. In this seminar, the challenge of constructing coordinate transformation and feedback for feedback linearization will be discussed. The recent discovery by Dr. Zhan in this area will be presented. Linearizing coordinate transformation and feedback are derived for some nonlinear system with special structures.

Biography

Dr. Wei Zhan is an Associate Professor and the program coordinator of the Electronics Systems Engineering Technology in the Department of Engineering Technology and Industrial Distribution at Texas A&M University. He recently joined the Department of Electrical and Computer Engineering as a faculty member with courtesy joint appointment. Dr. Zhan earned his D.Sc. in Systems Science from Washington University in St. Louis in 1991. From 1991 to 1995, he worked at the University of California, San Diego and Wayne State University. From 1995 to 2006, he worked in the automotive industry as a system engineer. In 2006, he joined the Electronics Systems Engineering Technology faculty at Texas A&M University. His research activities include nonlinear control system theory and applications to industry, system engineering, robust design, modeling, simulation, quality control, and optimization.