IEEE Distinguished Lecturer Program

專 題 演 講

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Self-Learning Control of Nonlinear Systems Based on Iterative Adaptive Dynamic Programming Approach

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演講時間：2012年9月14日(五) PM 15:00~16:30

演講地點：國立成功大學 資訊工程學系 4263 講堂(2F)

Abstract: The optimal control of nonlinear systems often requires solving the nonlinear Hamilton-Jacobi-Bellman (HJB) equation instead of the Riccati equation as in the linear case. The discrete-time HJB (DTHJB) equation is more difficult to work with than the Riccati equation because it involves solving nonlinear partial difference equations. Though dynamic programming has been a useful computational technique in solving optimal control problems for many years, it is often computationally untenable to run it to obtain the optimal solution, due to the backward numerical process required for its solutions, i.e., the well-known "curse of dimensionality". A self-learning control scheme for unknown nonlinear discrete-time systems is developed for this purpose. An iterative adaptive dynamic programming algorithm via globalized dual heuristic programming technique is developed to obtain the optimal controller with convergence analysis. Neural networks are used as parametric structures to facilitate the implementation of the iterative algorithm, which will approximate at each iteration the cost function, the optimal control law, and the unknown nonlinear system, respectively. Simulation examples are provided to verify the effectiveness of the present self-learning control approach.

主辦單位: IEEE Computational Intelligence Society Tainan Chapter
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