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DESIGN OF PSO FUZZY NEURAL NETWORK CONTROL FOR BALL AND PLATE SYSTEM

Xiucheng Dong[1], Yunyuan Zhao[1], Yunyun Xu[1], Zhang Zhang[1] and Peng Shi[2,3]

[1]Provincial Key Lab on Signal and Information Processing
Xihua University
Chengdu 610039, P. R. China
dxc136@163.com

[2]Department of Computing and Mathematical Sciences
University of Glamorgan
Pontypridd CF37 1DL, UK

[3]School of Engineering and Mathematics
Victoria University
Melbourne, VIC 8001, Australia
pshi@glam.ac.uk

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Abstract. *The ball and plate system is a typical multi-variable plant, which is the extension of the traditional ball and beam problems. Particle swarm optimization algorithm fuzzy neural network control (PSO-FNNC) scheme is introduced for the ball and plate system. The fuzzy neural network (FNNC) is optimized by the offline particle swarm optimization (PSO) of global searching ability, and the online radius basis function (RBF) algorithm ability of local searching. Then, the optimized fuzzy RBF neural network (FRBF) tuned PID controller. The simulation results demonstrate the potential of the proposed technique, especially tracking speed, tracking accuracy and robustness, is improved obviously, which embodies the nice characters of the PSO-FNNC scheme.*
Keywords: Ball and plate, Fuzzy neural network, PSO algorithm, PID

1. **Introduction.** The ball and plate system is an extension of the classical ball and beam system [1,2]. The system consists of a plate pivoted at its centre such that the slope of the plate can be manipulated in two perpendicular directions. A servo system consists of motor controller card and two servo motors to title the plate. Intelligent vision system is used for measurement of a ball position from a CCD camera. The problem of the motion control of this system is to control the position of a ball on a plate for both static positions and desired paths. The slope of the plate can be manipulated in two perpendicular directions, so that the tilting of the plate will make the ball move on the plate.

The ball on the hard plate is an unconstrained object which is able to move freely and which has no ability to recognize the environment. So, the unconstrained object cannot control its behavior by itself. This makes motion control of ball and plate system difficult.

Stabilizing control of the ball and plate system is to hold the ball in a specific position on the plate. Trajectory tracking control demands the ball to follow the given position reference. Stabilizing and trajectory tracking control of this system have been studied separately.