Synchronisation of SA and AV node oscillators using PSO optimised RBF-based controllers and comparison with adaptive control

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Abstract

This paper studies the synchronisation of SA and AV node oscillators using PSO optimised RBF-based controllers systems. High levels of control activities may excite unmodelled dynamics of a system. The objective is to reach a trade-off between tracking performance and parametric uncertainty. Two methods are proposed to synchronise general forms of van der Pol (VDP) model and their performance. These methods use the radial basis function (RBF)-based neural controllers for this purpose. The first method uses a standard RBF neural controller. Particle swarm optimisation (PSO) algorithm is used to derive and optimise RBF controller parameters. In the second method, an error integral term is added to the equations of RBF neural network. The coefficients of error integral component and parameters of RBF neural network are also derived and optimised via PSO algorithm. Simulation results show the effectiveness and superiority of proposed methods in both performances in comparison with the adaptive controller.

Keywords: synchronisation, van der Pol model, node oscillators, radial basis function, RBF neural networks, PSO, particle swarm optimisation, adaptive control, system dynamics, simulation, controller parameters, impulses, tracking performance, parametric uncertainty