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Fuzzy cognitive map (FCM) method for designing intelligent control algorithm on MIMO nonlinear systems

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This is a simple technique that can meet the needs of the system purposes like nonlinearity, MIMO, coupling effect, uncertainty and complexity. FCM method is the combination of fuzzy systems and neural networks methods which contains the robust properties of both methods. As the structure of FCM has the ability to design the controller based on the needs of the system and what is expected from the system to do, not how it works, it could be a suitable solution for nonlinear MIMO systems. The structure of FCM is a graph structure with simple mathematics based on tendencies or goals of the system. Therefore, the designing of the controller is not involved with complexity of the system and complex mathematical analysis for deriving the control law. In this study, in control scenario by FCM, the inputs and outputs of the system with other effective parameters in the process like actuators could be considered as concepts (MIMO characteristic). The nodes are connected to each other based on the relationship or effect of them on each other (possible coupling effects). Finally, the control signals are applied to the nonlinear dynamic model of the system. Consequently, the nonlinear MIMO controller with simple mathematics and algorithm by considering coupling effect could be designed based on soft computing method of FCM in order to apply on nonlinear MIMO systems. The benefits of FCMs are fast convergence due to the less mathematical calculation and analysis and helping to omit the artificial decoupling of variables due to its construction, accordingly the accuracy and sensitivity of control can be increased.

Biography

Farinaz Behrooz has completed her PhD in Control and Automation Engineering from Universiti Putra Malaysia, her Master's degree in Smart Technology and Robotics Engineering and Bachelor's degree in Electronics Engineering. She has published four papers in reputed journals and has filed a patent in Malaysia. She has more five papers under revision and modification in reputed journals.

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