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Modeling, design and implementation of multi input and multi-output control system for plasma position in Damavand tokamak

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In this work, a nonlinear model is introduced to determine the vertical and horizontal position model of the plasma column in Damavand tokamak. Using this model as a simulator, a multi-input and multi-output (MIMO) controller has been designed. Also this controller is implemented on digital signal processor (DSP) control system.
In the first stage, a nonlinear model is identified for plasma vertical and horizontal position, based on the multilayer perceptron (MLP) neural network (NN) structure. Estimation of the model parameters has been performed by back-propagation error algorithm using Levenberg–Marquardt gradient descent optimization technique. The model is verified through experimental data of plant. As the second stage, a MIMO controller is designed for model. Finally, the MIMO controller was implemented to simultaneously control of plasma vertical and horizontal position based on DSP processor. The practical results show appropriate performance of this controller.
In the control system, a real-time control modules were established based on TMS320C6717B DSP. Thanks to them, implementation of the classic and linear and nonlinear intelligent controllers was possible to control the plasma position parameters. This new platform can improve the quality and quantity of research activities in plasma physics for Damavand tokamak.
keywords: Tokamak, Plasma, Neural network modeling, MIMO controller, DSP.

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