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SOLVING PROBLEM OF CONTROLLING THE POSITION PLASMA CORD IN THE TOKAMAK USING A NEURAL NETWORK *)

[1]Andrianova R.R., [1]Khayrutdinov E.N., [1,2]Dokuka V.N.,[1,2]Khayrutdinov R.R., [2]Scopintsev D.A.

[1]National Research Centre Kurchatov Institute, Moscow, Russia, khayrutdinov_rr@nrcki.ru
[2]Troitsk Institute for Innovation and Fusion Research, Troitsk, Moscow, Russia, scopintsev.d.a@triniti.ru

Currently, plasma control in a tokamak is one of the key tasks of thermonuclear fusion. Application of neural networks will make possible to develop a system for magnetic control the position of the plasma column in a tokamak and to carry out the control itself in real time [1]. The position and shape of the plasma boundary depends on a set of responsible for the equilibrium of the plasma parameters at specified values of currents in the coils of the poloidal field, the total current in the plasma and its density profile.

A neural network has been applied to stabilize the position of the circular cross-section plasma column along a large radius. As an example, the installation of Tokamak T-15MD is considered. During the work of the neural network, the calculated parameters are compared with their programmed values and the resulting deviation signals are generated, which in turn are used to correct the values of currents in the coils of the poloidal system. For this purpose, the algorithm of deep deterministic reinforcement learning is used, which defines the optimal method for solving the task [2].

In this task, a linear plasma model obtained using the DINA code is used for deterministic reinforcement learning [3]. An equilibrium configuration of a circular cross-section plasma is used to obtain a linear plasma model, which is realized during plasma initialization at the physical start the tokamak.

A comparative analysis of controlling the position of the plasma column in a tokamak using a neural network and control with a standard PID-controller is carried out.

The application advantage of neural network in magnetic control tasks will appear during control of the shape, current and position of the column when the used controller becomes matrix and special knowledge and methods will be required for its development, and manual adjustment of the matrix controller for each time point of the tokamak scenario will be necessary.

The neural network will enable the development of matrix control for the whole scenario.

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