

# CONTENTS & ABSTRACTS

## PLASMA CONTROL IN TOKAMAKS. PART 2. MAGNETIC PLASMA CONTROL SYSTEMS . . . . . 2

**Mitrishkin Yu.V., Kartsev N.M., Pavlova E.A., et al.**

Various systems of magnetic control of plasma position, current, and shape are considered in vertically elongated tokamaks including spherical tokamaks being in operation. The systems of Resistive Wall Modes suppression are described. Tokamaks constructions and cross-sections, structural schemes of plasma control systems are given; heed is paid to operating principles of plasma control systems; experimental results of plasma control in tokamaks are given. Various engineering realizations of magnetic plasma control systems in tokamaks are presented.

**Keywords:** tokamak, plasma, plasma magnetic control, plasma position control, plasma current and shape control, resistive wall modes suppression, plasma control systems realization.

## FUZZY TWO-POINT BOUNDARY VALUE PROBLEMS IN MATHEMATICAL MODELING AND CONTROL. PART 2. FUZZY CONTROL . . . . . 31

**Demenkov N.P., Mikrin E.A., Mochalov I.A.**

The initial method is considered of solving a two-point boundary value problem for a second-order linear fuzzy differential equation and the example of its application is given. For the nonlinear case, the fuzzy Galerkin method is suggested, that is the modification of its traditional analog. As an example of fuzzy method realization the fuzzy periodic modes calculation is given for the automatic optimization system with the searching extremal controller with the extremum storing. It is shown that a complete fuzzy system of linear algebraic equations appears when calculating.

**Keywords:** fuzzy initial method, fuzzy Galerkin method, periodic mode, fuzzy automatic optimization system, fuzzy system of linear algebraic equations.

## OPTIMAL MOTION CONTROL OF THE SYSTEM MODELED BY DOUBLE INTEGRATOR OF FRACTIONAL ORDER . . . . . 40

**Postnova E.A.**

The problem is investigated of optimal control of a system, described with the model of fractional-order double integrator, in which the initial and final conditions depend on the appropriate time-point selection. Several cases are considered, physically similar to the system transfer from a state of the rest to a state of the uniform linear motion, to a uniformly accelerated and to a periodic motion, and from a uniform to a uniformly accelerated motion. The dependencies are analyzed of the control norm from the control time and from the fractional differentiation index value.

**Keywords:** Caputo fractional derivative, double integrator, problem of moments, optimal control.

## THE CORRECT ADAPTIVE MECHANISMS WITH IDENTIFICATION . . . . . 47

**Tsyganov V.V.**

The problems are considered of constructing the active systems functioning adaptive mechanisms that ensure both the intention of their elements to the fulfillment of plans, as well as the realization of their potential and the identification of their parameters. The problem is set of the correct design of an adaptive functioning mechanism for a two-level active system with identification, in which planning and plan fulfillment stimulating goes with the effective adjustment of active elements constraints models based on information on their inputs and outputs. The sufficient conditions are found of validity of the adaptive mechanism with identification. The results obtained are illustrated by the example of the mechanism of improving the rail transport energy efficiency.

**Keywords:** activity, adaptability, mechanism, plan, identification, energy efficiency.

## COGNITIVE LOAD ESTIMATION ON THE BASIS OF VIDEO INFORMATION USING RECURRENT NEURAL NETWORKS . . . . . 58

**Shishov B.A.**

In this work, the method of estimating cognitive workload is proposed. It is based on the idea to estimate workload using the video information from a camera with recurrent neural networks trained individually. To build a model, the workload is preliminarily estimated under special experimental conditions using task-based approaches while facial and gaze features are extracted from the video during the experiment. Using extracted information and workload estimation as training data cognitive workload is then modeled with recurrent neural networks with long short-term memory.

**Keywords:** cognitive load, operator estimation, recurrent neural networks, video analysis.

## EFFICIENT ALGORITHMS DEVELOPMENT FOR PREDICTING THE BRAKING MODE OF THE AIRCRAF . . . . . 66

**Shevchenko A.M., Nachinkina G.N., Gorodnova M.V.**

The methodology of designing algorithms for the length of the aircraft braking distance prediction is presented. The effective prediction algorithm is developed based on the energy approach to aircraft control. The new concept of prediction correction is proposed, allowing to improve not only its accuracy, but the degree of confidence in the prediction results also. Statistical tests of the algorithms have been performed under various conditions on the runway and under various aircraft configurations. The evidence of the prediction confidence is given.

**Keywords:** flight control, braking, energy approach, prediction.

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