Summaries

Jerzy Baranowski, Waldemar Bauer: **Trust Region Based Parametric Optimisation for Nonlinear Systems** • Automatyka/ Automatics 2012, Vol. 16, No. 1

In this paper, we propose the possibility of solution of parametric optimisation problem with a trust region algorithm. Problem of parameter optimisation is reformulated into initial condition optimisation resulting in analytical formulas for gradients and Hessian which are then subsequently used in the trust region algorithm. An example of nonlinear series DC motor controller optimisation is presented along with some numerical results.

Keywords: *parametric optimisation, trust region method, nonlinear systems, generalised PID control*

Krzysztof Kogut: **Semi-active Suspension System Modelling and Parameters Identification** • Automatyka/ Automatics 2012, Vol. 16, No. 1

This paper presents a study of obtaining a model of the real quarter-car suspension device. The system is equipped with an automotive engineering magnetorheological (MR) rotary brake. Due to the complex mechanical structure of the apparatus the considered model contains several simplifications. In the parameter estimation process the grey-box method was used, while the process itself was split into two separate steps. In the first step, the parameters of the nonlinear model of suspension part are identified and the static profile of the MR damper is experimentally determined. The second step is to estimate the parameters of the model of the wheel-eccentricity part. Comparison of the modelled system trajectories and real-time experiments are presented. The identification results show that the obtained model is accurate and can be successfully applied to simulate the device.

Keywords: *model identification, MR damper, semiactive suspension*

Paweł J. Mitkowski, Wojciech Mitkowski: **Stepped Basic Function in the Asymptotic Homogenization of an Elliptic System** • Automatyka/ Automatics 2012, Vol. 16, No. 1

The problem of asymptotic homogenization for one-dimensional stationary elliptic system was studied. The value of effective conductivity coefficient of homogeneous elliptic macroscopic system was determined for the basic cell approximated by a “stepped”

function. The conditions to obtain given conductivity coefficient, in the considered homogenization problem, were shown. Results of numerical calculations were provided to illustrate discussed issues.

Keywords: *asymptotic homogenization, elliptic system*

Krzysztof Oprzędkiewicz: **A Robust Suboptimal PD Servo Controller for an Oriented PV System** • Automatyka/ Automatics 2012, Vol. 16, No. 1

In the paper a synthesis of robust, optimal PD servo controller is presented. The control system under consideration can be applied in oriented photovoltaic (PV) system. The cost function describes both the energy consumption and settling time. The control plant is described by a transfer function with interval coefficients. The robust controller is required to keep the value of cost function in assumed limits and the closed-loop control system should be aperiodic for each value of uncertain parameter of the plant. To the construction of controller a geometric approach were applied. The results of simulations show, that the proposed controller is able to meet all requirements.

Keywords: *robust control, interval systems, oriented PV systems*

Grzegorz Sieklucki, Barbara Bisztyga: **Uncertainty Mathematical Models of Power Converters** • Automatyka/ Automatics 2012, Vol. 16, No. 1

The controller synthesis problem of the motor torque with parameters changes of the power converter is presented. The parameters uncertainty of the power converters described by gain and time-delay are analysed in the article. The principles of determining the range of the parameters variations are presented. The conversion method from the parametric to the dynamic uncertainty which can be useful to a robust controller optimization, is shown.

A multiplicative uncertainty weight as the oscillatory element is proposed. The tuning of the I I^2 controller parameters of the electromagnetic motor torque is introduced. The results are obtained by applying the mixed sensitivity method (robust performance) which is the optimization in $\mathcal{H}_\infty$ space.

Keywords: *thyristor-controlled converter, voltage source inverter, electric drive, multiplicative uncertainty, I I^2 controller, oscillatory element, robust control*

Wiesław Wajs: **Neural Network and Artificial Immune Algorithms for the Classification of Medical Data Series** • Automatyka/ Automatics 2012, Vol. 16, No. 1

This paper describes the applicability of artificial immune algorithms. Medical data series classification technique by Artificial Immune Algorithm is used for Neural Network Algorithm input data definitions. Artificial Immune Algorithms is created and trained for the purpose of Arterial Blood Gas parameters classification: pH, PaCO2, PaO2, HCO3. The main goal of this paper is to develop a artificial neural network technique for Arterial Blood Gases short-term prediction. The main question that is considered is how to predict some dynamic parameters that describe blood gases nature. A model of a physical system has an error associated with its predictions due to the dependences of the physical system's output on uncontrollable and unobservable quantities. The use of artificial methods creates the possibilities of obtaining some parameter values on the proper level of probability. This would provide a direct feedback to the clinical staff about the progress of a patient, the success of individual treatments, and quality of care as well as predicting blood gas value.

Keywords: *Artificial Neural Network, Immunological Network, SVM, BPD*