

Michał Ganobis: **Worst Case Controller Design for Uncertain System Using Game Theory** • Automatyka 2009, t. 13, z. 1

This paper is to present the possibilities of using game theory in control of a system with uncertain parameter. We will show how Pontryagin's maximum principle, and some results of differential games can be used to obtain optimal control and the most disturbing parameter behaviour. Methodology has been presented on physical example—a cart with an uncertain weight.

Keywords: game theory, uncertain parameter, optimal control

Adam Głowacz, Witold Głowacz: **Automatic Control of Temperature with Application of Motorola MC68HC908QT4CP Microcontroller** • Automatyka 2009, t. 13, z. 1

A new implementation of automatic temperature controlling with microcontroller Motorola MC68HC908QT4CP is shown. System was made. Code was also implemented. Investigations were carried out for special room. Results of investigations show that efficiency of the system is very high.

Keywords: control of temperature, microcontroller, device

Henryk Górecki: **New Method of Solution an Algebraic Equation of 4-th Degree** • Automatyka 2009, t. 13, z. 1

The paper presents a new method of solution the algebraic equation of 4-th degree. A special attention is paid in the case when two pairs of conjugate roots exist.

Keywords: solution, algebraic equation 4-th degree roots, geometry of conjugate roots

Adam Piłat: **Stiffness and Damping Analysis for Pole Placement Method Applied to Active Magnetic Suspension** • Automatyka 2009, t. 13, z. 1

The Author presents the nonlinear model of the active magnetic suspension system controlled by current, its linearization and stabilizing controller synthesis with a special attention given to the dynamical properties of the closed-loop system. The open and closed loop poles are given using analytical forms. The detailed analysis of closed loop poles and system properties is specially discussed. The analytical calculations show a range of controller

parameters and their influence on system dynamics. The experimental results confirms the analytical considerations and shows the object levitation with a given performance.

Keywords: *active magnetic suspension, real-time control, eigen values, stability, stiffness, damping*

Henryk Połcik, Witold Byrski, Bartłomiej Zawada, Mariusz Murawski: **Modeling of Solidification Process in Selected Alloy of Non Ferrum Metals by the Use of Software Package FLUENT** • Automatyka 2009, t. 13, z. 1

In the paper methodology of mathematical modeling and simulation methods of solidification process in AK9 aluminum alloy were presented as well as physical experiments based on real casting process. For numerical simulations commercial software package FLUENT available on CYFRONET Center supercomputers was used. During physical casting experiments for changing of solidification time the control of cooling process was performed and DAS value – which characterizes the structure of material was examined. The influence of water and oil for cooling process was analyzed. It has been assumed that the difference between the time required by the system to reach its solidus temperature and the time required to reach its liquidus temperature is the time of solidification. For changing of solidification time it was decided to increase the value of the molding sand thermal conductivity, as well. Strong similarities in the process dynamics were obtained between physical system and the model.

Keywords: *solidification time, aluminum alloy, software package FLUENT*

Andrzej Tutaj: **The Compensation for a Data Loss in a Distributed Control System** • Automatyka 2009, t. 13, z. 1

In a distributed control system there is a data transmission network inserted into a closed feedback loop. Through this network samples of signals (controls, measurements) are conveyed. Some networks and communication protocols do not secure a reliable delivery of data packets. In such networks some packets can be lost. In a distributed control system this phenomenon usually causes the quality of control to deteriorate and sometimes renders the system unstable. One possible countermeasure against this problem is described in the present paper. The idea is to supplement each single data packet conveying a current control value from a compensator to an actuator with several estimates of predicted future control

samples. This method can be employed if a network is inserted between a controller and an actuator. With the presented algorithm, if the current data packet is un-available an actuator can utilize an estimate taken from one of previous packets instead of a missing current control value. For this to happen, an actuator must be equipped with a buffer governed by an appropriate algorithm responsible for gathering data from a compensator and releasing them to an actuator. In some cases the strategy presented above is capable of securing a satisfactory quality of control and ensuring a system stability even though some data packets are missing. The presented paper describes in details the above-mentioned algorithm of data managing and presents results of simulations and laboratory experiments. The stability issue for the presented algorithm is also addressed.

Keywords: *distributed control system, state and control prediction, data loss in computer networks, time-varying dynamic system*