EDITORIAL

Dear reader,

In front of you is the special issue of AUTOMATIKA, with papers related to motion control systems. These papers have been selected from the presentations at 12th IEEE International Workshop in Advanced Motion Control, AMC 2012, held in Sarajevo march 25-27, 2012. Both industry and academia have been involved in fulfilling real-world needs in developing efficient design methods that will support never-ending requirements for faster and accurate motion control systems. High-precision manufacturing tools, product miniaturization, the assembly of micro and nanoparts, a need for high accuracy and fidelity of motion in robot-assisted surgery, electric vehicles, new energy sources, mass storages devices – in one way or another employ motion control. The range of applications of motion control systems attracted many researchers in this very diverse areas. This could be seen by looking at the papers selected for this special issue. This issue contains eleven papers covering diffrent areas of motion control application.

First paper presents a practical feedback controller design of a ball screw-driven table system for the micro-displacement positioning taking into account nonlinear elastic properties of friction of the mechanism in the micro-displacement region as well as Coulomb and/or viscous friction in the macro-displacement. These characteristics result in different positioning responses and frequency characteristics of the plant in the micro-and macro- displacement regions. Second paper deals with design of the contouring controller for high precision control systems. The trajectory generation algorithm, contour error construction method and finally the contour controller design are discussed. A combination of elliptical Fourier descriptors (EFD) and time based spline approximation (TBSA) is used to generate reference trajectory.

The control of resonant systems with communication time delay using a wave compensator is discussed in third paper. The solution is based on the usage of the reflected wave rejection using DOB and then using wave compensator based on CDOB in the outer loop to suppress vibrations.

The haptics applications are discussed in the fourth and fifth paper. Fourth paper proposes an evaluation index for the analysis of the motion complexity in parallel multi DOF haptic system. It has been shown that modal information can be represented by the Fourier coefficients. In the paper a total harmonic distortion (THD) of the haptic modal information as a haptic motion index is proposed and its utilization shown for multi DOF system. Fifth paper presents the FPGA implementation of the sliding mode control for bilateral teleoperation. The proposed implementation improves haptic fidelity by the widening the control bandwidth. The presented FPGA design methodology applies optimization in order to meet the requirements in terms of the control period and the hardware resource utilization.

Force control is discussed in the sixth and seventh paper. Sixth paper proposes techniques for improving the performance of resonance ratio control method. These are based on (a) a multi encoder based disturbance observer for load side disturbance estimation, (b) application of coefficient diagram method for controller gain selection and (c) estimation of the spring coefficient of flexible robot system. In the seventh paper zero-power magnetic levitation control and force control have been proposed for manipulators with spiral motor. In addition, a model of a musculoskeletal biped robot equipped with spiral motors is introduced.

Eight paper introduces a generator fault-tolerant control scheme for variable-speed variable-pitch wind turbines that can be applied regardless to the AC generator used. The focus is on gen-

erator stator isolation inter-turn fault that can be diagnosed and characterized before triggering the safety device. An extension of the conventional wind turbine control structure is proposed that prevents the fault propagation while power delivery under fault is deteriorated as less as possible compared to healthy machine conditions.

The driving force distribution in four-wheel road electric vehicle on a split slippery road is discussed in the ninth paper. New distribution force method is proposed. Its effectiveness in reduction of total driving force and elimination of yaw-moment is confirmed.

The tenth paper presents motion control in redundant flexure mechanism with PZT actuation. The aims of the work are to eliminate the parasitic motions of the stage, misalignments of the actuators, errors of manufacturing and hysteresis of the actuators by having a redundant mechanism with the implementation of a sliding mode control and a disturbance observe. The effect of the observer and closed loop control is presented by comparing the results with open loop control.

The eleventh paper discusses the design of motion control in mechatronics systems using the MFSM (Modular Finite State Machine), ECA (Event-Condition-Action) system, motion generation, motion control with load estimation, and an example of a DSP system. The limitations and attributes of each technique are discussed, and a state-table format is presented with the capability of representing parallel asynchronous sequential processes.

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