ABSTRACTS

Szymon Racewicz, Paweł Kazimierczuk
Light Two-Wheeled Electric Vehicle Energy Balance Investigation Using Chassis Dynamometer

The article presents the methodology for light two-wheeled electric vehicle energy balance investigation using MAHA LPS 3000 chassis dynamometer. For this purpose, the laboratory tests, as well as the road tests, have been performed on the self-constructed light two-wheeled electric vehicle equipped with the 3 kW BLDC motor and the 100.8 V battery pack. The road test data have been used to set up the dynamometer parameters in order to simulate the real road drive taking into account, among others, the rolling resistances and the air drag coefficient. The overall energy consumption for the laboratory tests and the road conditions' tests have been then compared for different vehicle speeds. In addition, based on the power and the torque characteristics measured on the MAHA chassis dynamometer, the efficiency of the vehicle electric drive system and the efficiency of the battery charging process have been calculated.

Dariusz Szpica, Andrzej Borawski, Grzegorz Mieczkowski, Michał Kusznier, Mohamed M. Awad, Adel M. Sadik, Mohammed Sallah
Evaluation of the Influence of the Supply Pressure on Functional Parameters of the Impulse Low-Pressure Gas-Phase Injector

The article presents research results referring to the influence of supply pressure on the functional parameters of the impulse low-pressure gas-phase injector. The study was done on the original stand for flow test of gas-phase injectors. In the indirect evaluation, with the initial parameters and the length of the forced impulse, the current line, acceleration and pressure sensor courses were used. Apart from the volumetric flow rate, the analysed parameters were the time periods of the injector opening and closing process. Those time segments were composed of response time and opening/closing time, the sum of which gives time of full opening. Functional relationships describing the volumetric flow rate, time of full opening and closing are presented, which are helpful not only in comparative tests of different injectors, but also in modelling the operation of gas injector or algorithms of gas supply control system. The reference to the volumetric flow rate allowed to indicate possible causes of variability of this parameter depending on the supply pressure.

Seif-El-Islam Hasseni, Latifa Abdou
Robust LFT-LPV H∞ Control of an Underactuated Inverted Pendulum on a Cart with Optimal Weighting Functions Selection by GA and ES

This article investigates the robust stabilization and control of the inverted pendulum on a cart against disturbances, measurement noises, and parametric uncertainties by the LFT-based LPV technique (Linear-Fractional-Transformation based Linear-Parameter-Varying). To make the applying of the LPV technique possible, the LPV representation of the inverted pendulum on a cart model is developed. Besides, the underactuated constraint of this vehicle is overcome by considering both degrees of freedom (the rotational one and the translational one) in the structure. Moreover, the selection of the weighting functions that represent the desired performance is solved by two approaches of evolutionary algorithms; Genetic Algorithms (GA) and Evolutionary Strategies (ES) to find the weighting functions' optimal parameters. To validate the proposed approach, simulations are performed and they show the effectiveness of the proposed approach to obtain robust controllers against external signals, as well as the parametric uncertainties.

Bogdan Sapiński, Łukasz Jastrzębski, Arkadiusz Kozieł
Ideal Rectifier Bridge Converting the Harvested Energy of Vibrations Into Electric Energy to Power an MR Damper

The newly developed ideal rectifier bridge equipped with four N-type MOSFETs and two rail-to-rail operational amplifiers is a part of a typical energy harvesting conditioning circuit responsible for the rectification stage in the system of converting the energy harvested from vibrations into electrical energy to power the MR damper. The only energy loss in the bridge is caused by the voltage loss in transistors' channels. The first sections of the work summarises the structural design of the bridge, the simulation procedure under the RL load and by sine voltage inputs with predetermined frequency and amplitude range, and benchmarks the results against those obtained for the conventional bridge based on Schottky diodes. In the second section, the PCB prototype of the bridge is analysed, and measurement data are compiled. The third section reports on the laboratory testing of the developed bridge converting the harvested energy in an MR damper-based vibration reduction system.

Myron Chernets, Myroslav Kindrachuk, Anatolii Kornienko, Alina Yurchuk
Experimental Estimation of Wear Resistance of Polyamide Composites, Reinforced by Carbon and Glass Fibers used in Metal-Polymer Gearings

The method of model triboexperimental studies to determine the basic mathematical model parameters of materials wear resistance at sliding friction is considered. The quantitative relative experimental characteristics of wear resistance of glass fibre and carbon fibre reinforced polyamide used in metal-polymer gear couple have been determined. Wear resistance functions of these functional polymeric composites have been established as the basic ones in the tribokinetic mathematical model of material wear for sliding friction conditions. Also, according to the conducted researches, wear resistance diagrams were constructed. They may be used as graphical indicators of wear resistance n the required range of specific friction forces. The dependences that connect the characteristic functions of wear resistance of these materials (obtained by the developed mathematical tribokinetic wear model) with linear wear and gearing service life are presented.