Simple hardware implementation of voltage balancing in capacitor-clamped inverter

Petr Kokeš, Radko Semerád

Abstract. The basic principle of voltage balancing in capacitor-clamped voltage source inverters (VSIs) is explained and a simple balancing algorithm, which is very suitable for hardware implementation, is proposed. The function of the suggested algorithm is verified in all usual steady and transient states of the induction motor drive by computer simulations of an 850 kW drive and also by experiments on a small 2.2 kW drive. Voltage unbalance across flying caps can occur only due to very fast transients in dc link. The balancing method is designed to preserve all benefits of the standard space-vector modulation and simultaneously to prevent an increase in the VSI average switching frequency above the PWM carrier frequency.

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Electromagnetic acceleration of ferromagnetic bodies

Karel Leubner

Abstract. Electromagnetic acceleration of ferromagnetic bodies is analyzed as a coupled electromagnetic-thermal problem. The mathematical model of the process consists of two ordinary differential equations describing the time evolution of the current in the field circuit and motion of the accelerated body and two partial differential equations describing the distribution of nonstationary electromagnetic and temperature fields. The model is then solved numerically by a combination of the finite element method and time integration of the circuit equations. The methodology is illustrated on a classical electromagnetic actuator with ferromagnetic plunger. Attention is paid mainly to its dynamic behavior and temperature rise of its structural parts.

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Effect of thermal gradient on free vibration of non-homogeneous visco-elastic rectangular plate of parabolically varying thickness

Arun K. Gupta, Lalit Kumar

Abstract. An analysis on free vibration of non-homogeneous visco-elastic rectangular plate with parabolically varying thickness subjected to linear temperature gradient is discussed. Vibrational behavior of non-homogeneous rectangular plates of variable thickness having two opposite edges simply supported is analyzed on the basis of classical plate theory. The other two edges are clamped. For non-homogeneity of the plate material, density are assumed to vary linearly in one direction. Using the method of separation of variables, the governing differential equation is solved. The use of trigonometric sine function for the mode shapes between the simply supported edges reduces the governing partial differential equation of motion for such plates to an ordinary differential equation with variable coefficients. Galerkin technique is applied. Deflection, time period and logarithmic decrement at different points for the first two modes of vibration are calculated for various values of temperature gradients, non-homogeneity constant, taper constant and aspect ratio for non-homogenous rectangular plate which is clamped on two parallel edges and simply supported on remaining two edges. A comparison of the results is presented.

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Passive and hybrid filters under distorted source condition

Marian Pasko, Dawid Buła

Abstract. Analysis of hybrid active power filter under distorted voltage system compared to passive filter is presented. Shunt hybrid filter with series connection of passive and active parts is taken into account. Harmonic source voltage influence on high harmonic compensation is shown. Relevant simulation and experimental results are also presented.

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Thermoelastic actuator with controllable shift

Václav Kotlan, Bohuš Ulrych, Ivo Doležel

Abstract. A new conception of actuator with controllable operation regime is presented. The actuator works on the principle of electromagnetically generated thermoelasticity and allows setting of extremely small accurate shifts on the order of 10^{-6}–10^{-3} m. The mathematical models of its principal parts are built and solved numerically. The application of the device is illustrated by two typical examples.

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Quadrant analysis of boundary layer above pitched and flat roofs

Radka Kellnerová,
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Abstract. Boundary layer over two types of urban roughness in wind-tunnel is investigated. The roughness is composed from rows of street canyons with two shapes of roof—flat and pitched. Different roofs produce different internal boundary layers above canyons. A layer generated by pitched roofs, is significantly more turbulent since it provides a larger vertical variation for the wind passing above. Momentum flux and corresponding transport exhibits diverse development, extension and magnitude as well. Ventilation in streets is therefore distinct from each other. Flat roofs generate rather larger eddies in street canyon, which does not disturb the ventilation significantly. Adversely, geometry of pitched roofs enables to wind to attack on the core of recirculation zone and break it. Quadrant analysis is applied for vertical profiles and cross-sectional areas in canyons in order to detect a domination of sweep or ejection events and to find a linkage to the third moment of velocity for both cases.

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Determining material parameters of damage

Petr Brož, Daniel Dobiáš

Abstract. Fast solutions to the problem of identifying material parameters of damage are suggested and performed. The methodology is supplemented with some minimization procedures, numerical identification approach, damage evolution law analysis, validation routine, and parameter sensitivity study. The results are crucial in continuum damage mechanics for predicting deterioration of structures, serviceability, reliability and manufacturability of both building and mechanical structures.

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