Combined analytical-numerical calculation of electrical machines

Rainer Helmer, Eike Garbe,
Jörn Steinbrink, Bernd Ponick

Abstract. A combined analytical-numerical calculation of electrical machines is dealt with. Analytical motor calculation tools need less time than numerical programs whereas considering geometric details or non-linear material properties is easier by using numerical methods. Thus it is proposed to combine both technologies. To decrease the calculation time, most possible parts should be calculated analytically and only a few numerically. In addition, the numerical calculation should run without time-consuming user interaction. Therefore the construction of FEM-models of arbitrary electric machines is automated. Furthermore a method is implemented to identify the parameters of a fundamental-wave model of salient pole synchronous machines within a short time by using FEM technologies. This model can be used for further calculations with analytical programs. The characteristic field factors of salient pole synchronous machines are also calculated numerically, as their analytical calculation leads to dissatifactory results. As an outlook for further research, two different approaches to calculate the transient reactances of synchronous machines are presented, as their analytical calculation is not reliable.

Back to Contents

Analysis and comparison of sensorless control methods for permanent magnet machine drives at low speed

Karsten Wiedmann, Axel Mertens

Abstract. The paper reports on sensorless control methods for permanent magnet machine drives at low speed, analysing the most promising approaches for sensorless control at low speed, which are the INFORM (indirect flux detection by online reactance measurement) method and the high frequency injection (HF Injection). In order to compare both methods, they are derived using the same voltage equation. This context is often missing in literature. Furthermore, the effect of the rotor position estimation on the overall motor control is characterised. This is necessary to set limits for stable operation areas of the motor. Theoretical foundations are substantiated by simulations.

Back to Contents

Energy of inviscid incompressible fluid flowing past two equal spheres

Alexander A. Kharlamov,
Zdeněk Chára, Pavel Vlasák

Abstract. A simple formula for the kinetic energy of potential flow of an inviscid incompressible fluid past two rigid impermeable equal spheres moving arbitrarily is obtained. The kinetic energy is an essential part of equations of motions of the spheres. The energy represents an expression involving the components of the sphere velocities and the dimensionless coefficients that depend on the dimensionless distance between the spheres. The coefficients were calculated numerically by the method of successive images. The image method allows calculation of the velocity field as the sum of the velocity fields of sequences of dipoles located along the axis connecting spheres centres. The coefficients in the energy expression as a function of dimensionless distance between spheres were calculated as an infinite series over all the dipoles modelling the flow. The limits and accuracy are estimated from the series. The obtained dependences were fitted with high accuracy by simple continuous functions.

Back to Contents

On the measurement of elongational viscosity of polyethylene materials

Petra Svrcinova, Alexander Kharlamov, Petr Filip

Abstract. Measurements of elongational viscosity for polyethylene materials using a SER Universal Testing Platform are analysed. Emphasis is paid to admissible acceleration of the whole measuring process and thus prevention from possible degradation of materials tested. There is presented a hint how to simplify (and accelerate) the measurements for a suitable class of materials including elimination of possible influence of the clamps (as a part of the SER Universal Testing Platform) on the measurement.

Back to Contents

Volume and enthalpy recovery of glass-forming polymers and the predictions controlled by internal energy

Pavel Říha, Petr Slobodian, Josef Kubát

Abstract. The volumetric and enthalpic response of poly(methyl metacrylate), *a*-PMMA, after a sudden temperature decrease or increase at T_g is described. The approach is based on a recently developed thermodynamically consistent non-linear viscoelastic theory of thermal and mechanical behavior of glassy polymers in the glass transition range. The original model is modified by replacing the stretched exponential relaxation functions by the relaxation functions based on a cooperative model where the elementary events tend to occur in clusters due to mutual induction reminiscent of the mechanism underlying Bose-Einstein statistics. The evolution of the specific volume and enthalpy is measured using mercury-in-glass dilatometry and differential scanning calorimetry, respectively. The used thermodynamic description is found to produce good agreement with the observed processes both with regard to its intensity and asymmetry when the evolution to the equilibrium state proceeds from higher and lower temperature.

Back to Contents

Electron beam energy deposition in non-uniform plasma of stationary beam plasma discharge

Alexander A. Serov

Abstract. Dependencies of power loss parameter realized in stationary beam-plasma discharge (SBPD) in magnetic field are studied both experimentally and by calculations. Longitudinal non-uniformity is shown to be important for realization of mechanisms weakening e-beam relaxation. Analytic expression is derived from quasi-linear theory to describe e-beam relaxation process in dependence on SBPD-system parameters. Predictions of the analytic expression are in good agreement with experimental data.

Back to Contents

Monte Carlo simulations of scattering and detection of pulsed neutrons from a plasma-focus source for detection of hidden illicit materials

Urszula Wiącek, Krzysztof Drozdowicz,
Barbara Gabańska, Ryszard Miklaszewski,
Vladimir Gribkov

Abstract. A new-generation plasma-focus device is proposed to be used in a new inspection system for detection of hidden explosives and other illicit materials. Fast neutrons are produced in the D-D reaction (2.45 MeV) and are emitted during very short ($\sim$ 10 ns) and intense pulses (up to 10^9 neutrons per pulse). The neutrons scattered by the investigated object are detected. Nuclide-specific information is present in the scattered neutron field and a deconvolution of these registered energy spectra should allow the identification of the type of unknown material. This type system allows using the time of flight method for the spectrometric analysis of the neutrons on a short flight path. A Monte Carlo modelling of the neutron transport in the proposed system has been performed. The MCNP code has been used. Scattering of the 2.45 MeV neutrons on model samples (spheres) in five directions has been investigated both for single elements characteristic for explosives (H, C, N, O) and such substances as RDX (the explosive), amphetamine (the drug) or melamine (the everyday use material). The angle-energy distributions of the scattered neutron flux are obtained. The corresponding time-of-flight distributions have been calculated. The full time-dependent pulsed neutron transport in the system has also been modelled independently with the MCNP code.

Back to Contents

Parasitic capacitances of power electrical systems and EMC

Irena Kováčová, Dobroslav Kováč

Abstract. Selected problems of electromagnetic compatibility (EMC) of converters and inverters used for feeding of electrical machines are analyzed by professional code PSPICE. The principal attention is focused on the parasitic capacitances and capacitive couplings.

Back to Contents