PhD Thesis Topic:

Magnetic Material Modelling and Simulations for Magnetic Sensors

PhD student: Mehran Mirzaei

Supervisor: Prof. Pavel Ripka

Czech Technical University
Prague, Czech Republic
Research works for PhD Thesis

1- B-H curves and Hysteresis loops modeling

Applications of developed models:

2- Effect of conductor permeability on electric current transducers

3- Position sensor design and analysis

4- Eddy current speed sensor design and analysis
B-H curves and Hysteresis loops modeling

\[ f(x) = \frac{a_1 \cdot x^{b_1} + a_2 \cdot x^{b_2} + a_3 \cdot x^{b_3}}{1 + a_1' \cdot x^{b_1} + a_2' \cdot x^{b_2} + a_3' \cdot x^{b_3}} \]

The proposed functions cover much wider range of magnetic fields than functions currently used in simulation software packages.

Effect of conductor permeability on electric current transducers

M. Mirzaei, P. Ripka, A. Chirtsov, P. Kaspar, J. Vyhnanek:
The Effect of Conductor Permeability on Electric Current Transducers,
AIP Advances 8, 047506 (2018)
Position sensor for pneumatic cylinder design and analysis


Eddy current speed sensor design and analysis

Eddy Current Linear Speed Sensor

Magnetic flux distribution

Axisymmetric model

Eddy current speed sensor design and analysis

Eddy Current Rotational Speed Sensor

Eddy current distribution

Eddy current speed sensor design and analysis

Eddy Current Rotational Speed Sensor
Eddy current speed sensor design and analysis

Flat Type Eddy Current Speed Sensor

Eddy current distribution

3- M. Mirzaei, P. Ripka, A. Chirtsov, J. VyhnaneK, V. Grim: Design and Modeling of a Linear Speed Sensor with a Flat Type Structure and Air Coils, Journal of Magnetism and Magnetic Materials, Volume 495, 1 February 2020, 165834
Flat type LVDT position sensor

M. Mirzaei, J. Machac, P. Ripka, A. Chirtsov, J. Vyhnanek, V. Grim: Design of a Flat Type Magnetic Position Sensor Using Finite Difference Method, Accepted with major revisions in IET Science, Measurement & Technology
Position sensor for pneumatic cylinder design and analysis

3- M. Mirzaei, P. Ripka, A. Chirtsov, V. Grim : Temperature stability of the Transformer Position Transducer for Pneumatic Cylinder, submitted to Journal of Magnetism and Magnetic Materials
Eddy current speed sensor design and analysis

4- M. Mirzaei, P. Ripka, A. Chirtsov, V. Grim: Eddy Current Speed Sensor with Magnetic Shielding, submitted to Journal of Magnetism and Magnetic Materials