SELECTION OF MAGNETIC FIELD'S PARAMETERS FOR WORKERS EXPOSURE ASSESSMENT

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Introduction

Various groups of workers are significantly exposed to the magnetic field from the low frequency range, in which permissible exposure guidelines are derived on the base of induced current density. In real working places, usually the space distribution of exposure is highly inhomogeneous (localised exposure). The sources of significant exposure could be hand-operated welding electrodes, heating inductors, etc. The presented investigation was done in order to select parameters of magnetic fields which are the highest correlated with induced current density, and which could be used for workers exposure assessment during field inspection's measurements.

Methods

The series of numerical FEM simulations were done with the use of anatomically shaped, homogeneous human body model and various mode's of localised magnetic field sources. Modelled magnetic field sources were placed in various localisation around human body model, which were referring to the typical working situations. Magnetic field distribution in the vicinity of the source and the density of current induced in the human body model were calculated in each case of simulations. The number of magnetic field parameters, which were defined to be representative for measurable parameters were calculated for each case of simulations. Calculated parameters were defined for RMS values of module of magnetic flux density because the isotropic hall probe measurements are the most convenient to make during inspections work.

Results

Obtained results of calculations indicated that the highest density of induced currents occurred on the surface of the trunk in all cases of magnetic field localisation. The correlation of this parameter with the selected parameters of magnetic fields were analysed with the use of non-parametric test (ρ-Spearman correlation factor - tab.).

Tab. The correlation of the density of the current induced in the trunk with the selected parameters of magnetic fields (analysis for 14 cases of various localised exposure typical for work places)

analysed cases the reason (selected parameter of magnetic field) - the exposure effect (density of the current induced in the trunk - *J*)	correlation factor ρ-Spearman	significance level *p* <
B-averV – J	0,61	0,01992
B-averVT- J	0,10	0,72292
B-averVH – J	0,41	0,14516
B-averH – J	0,35	0,21369
B-maxV – J	- 0,34	0,23318
B-maxHB – J	0,75	0,00223

where: *B-averV* - the results of the series of measurements done in the vertical axe of human body position, averaged over the body position (0-2 m from the ground); *B-averVT* - the results of the series of measurements done in the vertical axe of human body position, averaged over the trunk position (0,8-1,6 m from the ground); *B-averVH* - the results of the series of measurements done in the vertical axe of human body position, averaged over the head position (1,6-1,8 m from the ground); *B-averH* - the results of the series of measurements done in the horizontal cross section of the trunk, averaged over the body position; *B-maxV* - the maximum result of the series of measurements done in the vertical axe of human body position (0-2 m from the ground); *B-maxHB* - the maximum result of the series of measurements done at the surface of the workers body; all parameters established as the models of the results of the series of measurements done with the use of isotropic, hall probe magnetic flux density meter.

Conclusion

The isotropic magnetic flux density measurements' results are not highly correlated with the exposure effects which occur inside the body of exposed workers. The obtained results indicated however, that two parameters relatively easy to measure and relatively highly correlated with the exposure effects could be use for inspection measurements - *B-averV* and *B-maxHB*. *B-averV* is lower correlated, but more repetitive during inspection measurements. *B-maxHB* is higher correlated but less repetitive during inspection measurements.

The obtained results suggest that the parameter *B-maxHB* of magnetic field distribution in the work place seems to be the most suitable for inspection measurements done to assess the particular worker's exposure to low frequency localised magnetic fields, but *B-averV* seems to be the most suitable for assessment and comparison of various work places.