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SUMMARY

„Computational identification of electromagnetic fields in the vicinity of power facilities for the purpose of assessing exposure of the public"

The main goal of this work was to develop a mathematical and physical model useful for the computational identification of the intensity distribution of the electric component of the electromagnetic field and a computer application based on this model that allows to estimate the impact of power equipment and as well the lines on the environment. The main emphasis was placed on the possibility of conducting analyzes of complex cases in which, in addition to power facilities such as overhead power lines (also multi-track), there are also foreign elements in the area under consideration, i.e. not directly related to their functionality. Every material object in the electric field causes deformation of the force lines of this field. Thanks to well-thought-out and planned activities, such as the use of natural or artificial elements of the environment, it is possible to significantly influence the resultant distribution of the electric field. Consequently, it is possible to shape the electric field in order to lower the maximum values of its intensity, as well as the area in which it occurs. The mathematical and physical model, based on the so-called the modified differential method allows for numerical determination of the resultant electric field intensity generated by any power objects, in the vicinity of which other objects are present (i.e. buildings, trees, barriers of any shape). The modified differential method, due to the possibility of local mesh refinement, allows increase the accuracy of calculations and more precise mapping of objects applied to the mesh. This method combines the advantages of the difference method and the finite element method. In the case of identification of the electric field intensity distribution, both by means of calculations and measurements, the values of the electric field potential or intensity are determined at evenly spaced points in space. For this reason, the uniform grid of differential elements can be locally compacted in order to better represent the areas in which the electric field distribution is strongly uneven, while not limiting the universality of the proposed method. In addition, unlike many methods based on e.g. the superposition and mirror reflection methods, the mathematical and physical model developed for the purposes of this paper allows for digital simulation of cases concerning power objects embedded in a substrate of any geometric structure, including on a sloping or undulating terrain. Due to taking into account all objects that may have an impact on the resultant distribution

of electric field intensity during the calculations, it is a universal tool supporting the design processes as well as the modernization of power facilities. It also makes it possible to determine the exposure to which workers are exposed when performing live work at power facilities and to determine the permissible working times on this basis.

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