European Association for the Development of Renewable Energies, Environment and Power Quality (EA4EPQ)

International Conference on Renewable Energies and Power Quality (ICREPQ'10)
Granada (Spain), 23th to 25th March, 2010

Reduction of Electric and Magnetic Field Emissions caused by Overhead Power Lines

K. Deželak[1], G. Štumberger[1] and F. Jakl[1]

[1] Universty of Maribor
Faculty of Electrical Engineering and Computer Science
Smetanova 17, 2000 Maribor, Slovenia
Phone/Fax number:+386 2 220 7180 / +386 2 220 7272, e-mail: **klemen.dezelak@uni-mb.s**i

Abstract. Calculations and measurements of magnetic and electric fields of overhead power lines existing in Slovenia show that electromagnetic field emissions on the border of overhead power line right of way could be too high. The allowed electromagnetic field emissions defined by Slovenian government in 1996 are very strict especially for newly constructed overhead lines. For that reason some modification should be applied for newly constructed overhead lines. This paper proposed a few solution of aforementioned problem regarding arrangements of overhead power line conductor.

Key words

Overhead lines, magnetic field, electric field, conductor arrangements.

1. Introduction

In 1996 Slovenia accepted quite strict values of magnetic and electric field emissions on the borders of overhead power lines right of way [1]. Those values are especially strict for newly constructed or only reconstructed overhead lines (B = 10 μT, E = 0.5 kV/m), while for old, existent overhead lines limits values are not so strict. For that reason, old practises of overhead lines constructions can not be applied for newly constructed overhead lines (Figs. 1 and 2). This work deals with possible solutions, which can be applied in the process of the new overhead line construction, to reduce electromagnetic fields emissions.

2. Reduction of electric and magnetic field emissions

The first solution, possible only for double-circuit overhead lines, is exchanging of conductors succession. The second solution is the usage of higher overhead lines tower, where conductor arrangements is the same, while the third solution is reduction of electromagnetic field emissions based on conductor arrangements obtained in an optimization process [2]. The first treating solution for reducing B and E caused by overhead lines shows that B and E can be reduced, but values of E is still higher than prescribed. The second solution shows that with higher tower the magnetic and electric field can be reduce but due to essential increase of costs this solution is not appropriate. For that reason the third solution of reducing B and E based on conductor arrangements obtained by an optimization process was applied (Figs. 1, 2). The basic idea is that each conductor position is described by two parameters changing during optimization, while main parameters of objective function are magnetic and electric field on the order of overhead power line right of way. The applied optimization method is Differential Evolution.

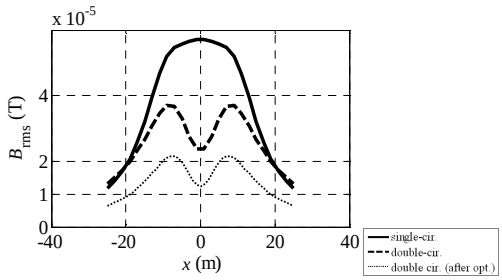

Fig. 1. Magnetic field density calculations for single-circuit and double-circuit Slovenian overhead power lines.

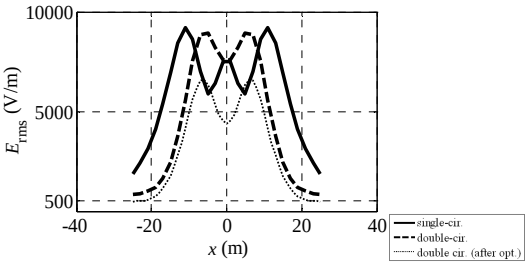

Fig. 2. Electric field strength calculations for single-circuit and double-circuit Slovenian overhead power lines.

References

[1] Official Gazette of the Republic of Slovenia No. 70/96, "The Decree on Electromagnetic Radiation in the Natural and Living Environment", 1996.

[2] K. Deželak, G. Štumberger, F. Jakl, "Arrangements of overhead power line conductors determined by differential evolution", HRO CIGRE, Cavtat, 2009.