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# Application of modified charge simulation method as solution to two-wire lines

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## Abstract

The paper presents the application of modified fictive sources method for determining electrostatic values of two-wire lines. It involves the combined application of fictive sources and conformal mapping methods. As the obtained results suggest, the method is superior to that of the classical fictive sources method in respect of the speed of convergence, and can also be used for solving multi-conductor lines.

**Key words:** Conformal mapping, electric field intensity, charge density, charge simulation method.

## Method description

In order to get as accurate results as possible for the field intensity in the close area of sharp conductor edges as well as on its edges, the authors propose the combined fictive sources and conformal mapping methods of isolated electordes, which is in the essence of the modified fictive sources method. Firstly, mapping of the conductor's field of an outer part of a unit circle is performed, whereby the contour which limits the conductor cross-sectional area is mapped into the unit circle. The fictive sources method is subsequently applied in a conventional manner and fictive charge values are determined.

Since complex mapping function has already been determined, it is used for the mapping of points  $\underline{z}_k$ , where fictive charge can be found in the inner part of the second conductor in the points

$\underline{w}_k$ . In this manner we can obtain the equivalent electrostatic system in  $\underline{w}$ -plane comprising a very long conductive cylinder of the unit, circular cross-section and a stack of parallel conductors charged with longitudinal fictive charge  $q'_k$  lying in points  $\underline{w}_k$ . For the given system, upon the application of the theorem of face mill image, a complex potential is determined as well as the other needed values. This is a very reliable method concerning field intensity and surface charge density per conductor area. This primarily refers to sharp edges where one can choose a point through which a contour is set as a boundary of a conductor cross-section. Steadiness of the results is also reflected in the fact that the method does not change with the change in the number of the used fictive sources. Thus, we have evaded the bad conditioning of the linear systems of the equations which always occurs with the method. Additionally, the application of the proposed method requires fewer equations, which evades improper conditioning of the linear systems of equations accompanying the application of the method.

Figure 1 presents the cross-section of a two-wire line with rectangular conductors. The positioning of the fictive sources is also shown. Firstly, we make the sharp edges of a line rounded so that the radius of the edges is  $r_0 > 0$ . Secondly, the fictive sources are set inside the conductor (indicated with broken line in Fig. 1).











