# A CORRECTION ALGORITHM FOR SEARCHING FOR THE ROOTS OF THE DETERMINANTS OF AN IMMITANCE MATRIX

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The main features of the use of a parametric criterion for estimating the accuracy with which the coordinates of the root are calculated in the modification method are considered. It is shown that the criterion is an effective method of searching for roots, particularly in degenerate cases ("splitting" of multiple roots, when introducing a "grown" reactive branch of a new root in a polynomial, etc.).

The modification method for calculating the coordinates of the roots of complex circuits [1] consists of three stages: 1) approximation of the trajectory of motion of each root by a Taylor series with respect to the admittance of a "grown" parameter, and calculation of the approximation of the modification of the root; 2) correction of the value of the coordinate of the root not by an approximate Taylor series, but from the accurate dependence of the admittance $w_i$ on the value of the coordinate of the root; and 3) estimation of the accuracy of the corrected pair of parameters $p_j$ and $w_i$ using the criterion of the deviation of the true value of the admittance $y_i$ from the value $w_i$ in the Taylor series assuming that the calculated value of the modification of the root $p_j$ is accurate. In this paper we consider the problems involved in realizing the second and third stages, which were not investigated in detail in [1].

Suppose that when "growing" a relationship with the admittance $w_i$ between two subcircuits, the first approximation of the modification of the roots $p_j$ is calculated in accordance with a k-th order Taylor series. Then an error $\delta p_j < \varepsilon$ occurs, the value of which is small if the step $\Delta w_i$ is chosen so that the relative contribution of the terms of the Taylor series from the t-th with respect to the k-th in the calculated value of $p_j$ is less than a certain previously specified error $\varepsilon$. However, as one calculates the modification of the root $p_j$ both with respect to the parameter $w_i$ and with respect to other parameters $w_1, \ldots, w_{i-1}, w_{i+1}, \ldots, w_m$, the error will accumulate and the calculated trajectory will depart more and more from the true one. Moreover, for a Taylor series we do not know the contribution of derivatives of the n + 1-th order and higher, which may also lead to a considerable error. Hence, to avoid the build-up of errors at each stage of the modification, additional correction is necessary.

To correct the result we will use the following considerations. The determinant of the function of the whole circuit (or the determinant of the function of two connected subcircuits) as a function of the "grown" parameter $w_i$ can be represented in the form

$$\Delta(p, w_i) = \Delta(p)|_{w_i=0} + w_i \frac{\partial \Delta(p)}{\partial w_i}\Big|_{w_i=0}. \quad (1)$$

If the roots of the polynomial $\Delta(p)$ are known, then for each $p_j$ expression (1) can be represented in the form

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