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ANALYSIS OF THE POSSIBILITY OF ACCOUNTING FOR THE ANTENNA REFLECTION COEFFICIENT IN DISPLACEMENT MEASUREMENTS BY PROBE METHODS

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The aim of this work is to choose a probe method for displacement measurement that could be modified to account for the horn antenna reflection coefficient, which can hardly be neglected if the target–antenna distance is large enough. Four methods were considered: a single-probe method in which the phase ambiguity problem is resolved by using the fact that the target displacement and velocity are continuous time functions, a two-probe method in which the target velocity is determined by differentiation of the detector currents and then integrated to give the displacement, a two-probe method in which the detector currents are differentiated twice to exclude the unknown magnitude of the target reflection coefficient, and a two-probe method in which the target displacement is determined from the quadrature signals using a phase unwrapping technique; as a result, the last-named method was chosen. That method determines the magnitude and the wrapped phase of the complex reflection coefficient of the target theoretically exactly for reflection coefficient magnitudes no greater than $2^{-1/2}$. Because of this, the chosen method allows one to determine the complex reflection coefficient of the horn antenna at the end of the waveguide section with the probes, whose magnitude is rather small, from the detector currents measured with the horn antenna operating into a matched load. The approach underlying the chosen method made it possible to express the quadrature signals, which contain information on the distance to the target, in terms of the detector currents, the known complex reflection coefficient of the horn antenna, and the unknown magnitude of the complex reflection coefficient of the target and to derive an equation in the last-named. The results obtained may serve as a basis for the development of probe techniques for displacement measurement with due account for the horn antenna reflection coefficient.

Keywords: *complex reflection coefficient, displacement, electric probe, horn antenna, semiconductor detector, waveguide section.*

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