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PHASE AMBIGUITY RESOLUTION IN RELATIVE DISPLACEMENT MEASUREMENT BY MICROWAVE INTERFEROMETRY

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This paper addresses microwave interferometry, which is widely used for displacement determination in various engineering applications. The aim of this paper is to develop a technique for phase ambiguity resolution in measurements of the relative displacement of mechanical objects using a two-probe implementation of microwave interferometry. To determine the wrapped phase from the quadrature signals, it is suggested to use the smaller positive root of the biquadratic equation that relates the unknown reflection coefficient to the currents of the semiconductor detectors connected to the probes. The reflection coefficient range and actual wrapped phase range in which the wrapped phase determined in this way is an apparent one are found. It is shown that the displacement determination error that is due to the difference of the apparent and the actual wrapped phase is nonzero only for sufficiently large reflection coefficients and does not exceed a few percent of the operating wavelength. It is found that for the target dimensions and the target–antenna distances for which the plane wave approximation holds, the proposed technique determines the vibration peak-to-peak amplitude to within several tenths of a percent even for peak-to-peak amplitudes several times greater than the operating wavelength. The proposed technique may be used in the development of displacement sensors with a simplified hardware implementation.

Keywords: *phase ambiguity, complex reflection coefficient, electrical probe, semiconductor detector, waveguide section, interprobe distance*.

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