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INTERPROBE DISTANCE ERROR COMPENSATION IN PROBE MEASUREMENTS OF MECHANICAL DISPLACEMENT

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Probe measurements of the displacement of mechanical objects by microwave interferometry are highly attractive in terms of hardware implementation simplicity. At present, the commonly used interprobe distance is one eighth of the guided operating wavelength. Implementing this interprobe distance with a high degree of accuracy may be a challenge, especially in the millimeter-wave band. However, probe methods that use an arbitrary interprobe distance are reported in the literature too. Because of this, the problem may be reduced to determining the actual interprobe distance. This paper presents a simple method for the determination of the actual interprobe distance by electrical measurements with the use of a short-circuiting piston. In this method, the interprobe distance is extracted from the currents of the semiconductor detectors connected to the probes. First, the short-circuiting piston is positioned so that the current of the probe that is farther from piston (the far probe) is a maximum, and the current of the probe that is closer to the piston (the near probe) is measured. Then the short-circuiting piston is moved away from the probes until the current of the far probe becomes equal to the half-sum of its maximum and minimum values, and the current of the near probe is measured again. From these measurements, trigonometric functions whose argument includes the ratio of the interprobe distance to the guided operating wavelength are found. The interprobe distance can be determined unambiguously from these trigonometric functions provided that the interprobe distance accuracy is within one fourth of the guided operating wavelength, which is usually met in actual practice. The method may be used in the manufacturing of microwave displacement sensors

Keywords: *complex reflection coefficient, displacement, electrical probe, interprobe distance, microwave interferometry, semiconductor detector.*

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