Step height determination by a focused Gaussian beam

Danny Levy
Liviu Singher
Joseph Shamir, FELLOW SPIE
Yehuda Leviatan
Technion-Israel Institute of Technology
Department of Electrical Engineering
Haifa 32000, Israel
E-mail: jsh@ee.technion.ac.il

Abstract. The interaction of a focused laser beam with a step on a conducting surface is investigated by a vector method. The 2-D problem is solved by using a model of fictitious current filaments, while 3-D problems are treated by using a model of fictitious dipoles as the sources of the scattered field. Computer simulations indicate a difference between the two polarization components (*TE* and *TM*), but with the samples investigated in this work, these differences are too small for practical measurements. The scattered field distribution is found to be strongly dependent on the step height relative to the observation plane and on its position relative to the beam waist. Thus, measurements of the intensity distribution in the observation plane can provide information about these parameters with high sensitivity. Experimental investigation confirms that the height of a step in the range $\lambda/10$ to $\lambda/4$ can be measured with an accuracy of 5%, including its sign (up or down). The position of the step with respect to the beam can be estimated with an accuracy of about 1/100 of spot size.

Subject terms: surface profile analysis; vector diffraction; scattering.

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