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The Effect of Roughness on Blazed Gratings for the EUV[1] ETHAN EDWARDS, STEVEN TURLEY, Brigham Young University — When the wavelength of light is comparable to the scale of a surface's roughness, physical and geometrical optics approximations of reflectance fail. Since even the smoothest surfaces have nanometer-scale roughness, finding alternative methods is important in the extreme ultraviolet. To directly calculate reflectance, one can solve the electric field integral equation (EFIE) over a surface. In this project the Nyström method was used with the EFIE to calculate far-field reflection of monochromatic plane-wave light from a one-dimensional blazed grating. Three imperfections were studied: uncorrelated and correlated random variation in line spacing, and surface roughness. Changes in resolution and resolving power were considered. These were compared to an ideal blazed grating at the Littrow configuration for first-order diffraction. The impact of random variations up to 5% of ideal line spacing and grating amplitude were studied alone and in tandem with other relevant defects. Each test was performed 1000 times to find the net effect of roughness for various random surfaces. Tests were performed for grating widths up to 1mm, line spacings between 1000-5000 lines/mm, and wavelengths from 30-100nm. Results are given and discussed.

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