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A Novel Technique For Wavelength Sensing Using AC Photocurrent Measurements

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This paper illustrates a novel technique of wavelength sensing for wavelengths in the visible range of the radiation spectrum using ac photocurrents. It is shown that the ratio of the ac to the dc photocurrents of a monochromatic light, obtained using a 'drift-type' photodiode, is unique for each wavelength at all reverse bias voltages. The value of the current ratio increases by at least one order of magnitude for wavelengths ranging from 530 to 720 nm. It is also shown that the ratio of the photocurrents is independent of the intensity of the light and the quantum efficiency of the device. This fact makes the technique particularly attractive for practical applications because these parameters may not be known a priori.

1. Introduction

The vision of computers, in applications such as image processing and automated manufacturing, has been limited to 'seeing' the grey shades only. Recently, there has been some interest in developing vision systems that are capable of recognizing colors.[1,2] Several microelectronic color sensors have been proposed which are capable of detecting wavelengths corresponding to the primary colors (red, green and blue), and therefore, of determining the 'color' of the incident light. Some devices, including p^+-n diodes[3] formed in single-crystalline silicon, and Schottky diodes[4] and p-i-n/p-i-n stacked junctions[5–7] fabricated in amorphous silicon, utilize the intrinsic wavelength filtering property of silicon for the detection