Abstracts

Modeling of Waveguide PIN Photodetectors Under Very High Optical Power

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In this paper, the behavior under very high optical power of waveguide PIN photodetectors grown on InP substrate is simulated. The problem is solved using a pseudo-bidimensional Drift-Diffusion model which describes the electrical behavior of the device including the effects of the external circuit. The optical behavior of the device is analysed using FD 2D and 3D Beam Propagation Method. First, we present the optical behavior of the device when the illumination conditions change. Influence of device structure, spot width, spot position and injection angle on the quantum efficiency of the photodetector is so studied. Second, the whole modeling is validated using experimental results given in the literature. Three typical multimode structures which allow a high cut-off frequency as well as a good responsivity are then modeled and compared. The smaller one has a cut-off frequency of 75 GHz in small signal conditions and the main effect decreasing the microwave output signal when the optical input power increases is the carrier effect in the depletion region of the photodetector. The maximum microwave power of each photodetector is calculated in typical conditions of use.

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