

Abstracts

Numerical analysis of traveling-wave photodetectors' bandwidth using the finite-difference time-domain method

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We present full-wave analysis of traveling-wave photodetectors (TWPDs) using the finite-difference time-domain (FDTD) method. Impulse response in the frequency domain is obtained after time-domain data are calculated by the FDTD method. The impulse response includes the optical field profile, carrier transit time, microwave loss, microwave dispersion, and velocity mismatch all together. Three-decibel bandwidth is analyzed with the thickness of an i-layer and waveguide width as the design parameters. It is shown how transit time and microwave characteristics affect the bandwidth according to the TWPD's length. Three-decibel bandwidth is dominated by carrier transit time in case the device length is shorter than 300-500 μm under the conditions given in this paper. However, if the device length gets longer, microwave characteristics affect the bandwidth.

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