Abstracts

A four-port scattering matrix formalism for p-i-n traveling-wave photodetectors

I. Huynen and A.V. Vorst. "A four-port scattering matrix formalism for p-i-n traveling-wave photodetectors." 2000 Transactions on Microwave Theory and Techniques 48.6 (Jun. 2000 [T-MTT] (Mini-Special Issue on the 1999 IEEE Radio and Wireless Conference (RAWCON))): 1007-1016.

This paper presents a full four-port characterization for traveling-wave optoelectronic devices, in particular, traveling-wave photodetectors (TWPDs), resulting in a scattering matrix formalism, which can be used for passive as well as active devices. A set of coupled distributed equivalent circuits is proposed for modeling the device, taking into account the wanted detection and spurious emission of light. A scattering matrix formalism is established, predicting the performances of the device at microwaves, when a microwave signal is used either for modulating the intensity of the optical power (forward detection mode) or for biasing the p-i-n junction (reverse emission mode). Hence, the obtained four-port device is nonreciprocal. Some symmetry properties are induced by the physical symmetry of the device. It has matched inputs, when symmetric electrical and optical reference loads are used. The scattering matrix satisfies power conservation laws. The formalism may be used to optimize the designs of TWPD's by varying the loads at each of the four ports.

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