Abstracts

Propagation in One-Dimensional Random Media

H.E. Rowe. "Propagation in One-Dimensional Random Media." 1971 Transactions on Microwave Theory and Techniques 19.1 (Jan. 1971 [T-MTT]): 73-80.

Propagation in one-dimensional random media is studied using matrix methods. This work applies, for example, to plane wave propagation in layered-media TEM transmission lines with random spacing, etc., where the spurious mode is a reflected wave. The imperfection is assumed to have a white spectrum. Similar techniques have previously been applied to multimode waveguide where the spurious mode is a forward wave. The present work is of interest because it yields exact computable results for certain transmission statistics in a simple way. These may be of help in comparing various approximate perturbation theories and in finding out what happens to signals in very long random transmission media where perturbation theory fails. Specifically, we compute the expected value and the variance of the complex loss (input/output) for lossless (i.e., zero heat loss) and lossy random media. In the lossless case only we compute the expected reciprocal input resistance and conductance, which Zakai has previously shown to be computable using a different approach. The imperfection (e.g., dielectric constant epsilon(x) of a continuous random medium, capacitance C(x) of a TEM line) is assumed to consist of a dc component and a white ac component. The more practical case of a flat low-pass spectrum for the ac component is considered, and the region of applicability of the present results to this problem is indicated. Similar methods may be used to calculate the covariance of the (complex) loss and higher moments of the loss and of the reciprocal input resistance and conductance for zero heat loss, although these calculations are not carried out here. The covariance would be required in order to study signal distortion in such a random medium.

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