Abstracts

Optimum Coupling for Random Guides with Frequency-Dependent Coupling

D.T. Young and H.E. Rowe. "Optimum Coupling for Random Guides with Frequency-Dependent Coupling." 1972 Transactions on Microwave Theory and Techniques 20.6 (Jun. 1972 [T-MTT]): 365-372.

We obtain exactly the covariance of the signal-signal and signal-spurious mode transfer functions of the coupled line equations with two forward-traveling modes, white random coupling with statistically independent successive values (e.g., white Gaussian or Poisson coupling), and a coupling coefficient that varies with the frequency of the signals on the line. No perturbation or other approximations are made in this work. Time-domain statistics for the corresponding impulse responses are obtained for moderate fractional bandwidths. These results are extensions of a similar treatment for frequency-independent coupling coefficients, given in a companion paper. If the coupling were independent of frequency, the signal distortion would ultimately decrease as the coupling increased, approaching zero as the coupling approached infinity. The frequency dependence of the coupling coefficient prevents the distortion from approaching zero; the optimum coupling, which achieves minimum signal distortion, is independent of guide length. Millimeter waveguides and optical fibers with random straightness deviations have coupling coefficients inversely proportional to the frequency. The above results yield the optimum random straightness deviation for such a guide. More forward modes can be treated in a straightforward way by more complicated calculations.

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