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LINEAR STOCHASTIC SYSTEMS COUPLED WITH MEMORYLESS NONLINEARITIES

by

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Summary

Our motivation to study this class of systems comes from a basic need to develop analytical methods to analyze and evaluate radar systems' performance in a realistic environment and in particular with distributed targets. We need, therefore, simple probabilistic models for the various "noise" processes that influence radar behavior in such an environment (e.g. amplitude scintillation, angle noise, sea clutter and sea multipath effects). In our previous work we have succeeded in developing such models that match very well experimental evidence concerning the statistics of such noise processes. The models developed consist of linear stochastic systems coupled with smooth memoryless nonlinearities. In this paper we report our current efforts to study such systems by analyzing the functional expansion that expresses the input-output behavior. In particular, we establish conditions for the statistical validity of a finite functional expansion and techniques for obtaining directly the required kernels from experimental data. We also discuss applications to some radar related detection problems. Finally, we indicate how these results can be extended to more general classes of systems than the ones we have considered to date.

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