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20. **Abstract (Continue on reverse side if necessary and identify by block number)**: This report describes progress on the referenced contract for the fiscal year 1982. This progress includes results in a number of problems concerned with minimax robustness in communication and control.
ANNUAL PROGRESS REPORT

for

Office of Naval Research
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2. Summary of Progress During Reporting Period

The primary direction of progress on this project during the reporting period has been toward the development of general formulations for robustness problems in communications and control. Generally speaking, a robust procedure is one which is insensitive (in terms of performance) to deviations from an assumed model. One of the most successful approaches to robust design is a game theoretic one in which a procedure is sought to have the best worst-case performance over a relevant class of models neighboring the assumed (i.e., nominal) model. Thus, the primary design philosophy in this area has been minimax, and the current progress has been directed toward general minimax results for these robustness problems. A brief description of the results obtained during the reporting period is contained in the following paragraphs. More complete details of these results can be found in the publications listed at the end of this discussion.

Many of the robustness problems that have been studied in the past such as robust location estimation and robust matched filtering exhibits a common structure which, although reasonably tractable, does not fit within the classical minimax theory. This common structure has prompted the study of a general class of minimax problems, examples of which include most of the previously studied
formulations of robustness. The formulation of this general problem and the characterization of its solution is found in a series of papers [11], [22], and [23]. This formulation has been applied to several aspects of the problems of robust observer and regulator design for linear stochastic systems in [10], [20], and [21]. These results, which are for finite-length observations and time-varying systems, generalize our earlier work dealing with the steady-state versions of these problems (various aspects of the steady-state regulator design problem are reported in [4], [17], and [18]).

Another aspect of our work during this period has dealt with the problem of robust stationary linear filtering for uncertain spectral models. An extensive numerical study reported in [6] and [24] indicates that conventional minimum mean-square-error filters can be undesirably sensitive to deviations from assumed spectral models, but that minimax filters are much less sensitive (i.e., they are more robust). Thus, we have studied several aspects of minimax linear signal estimation for stationary models. This work includes a study of robustness in the general discrete-time stationary signal estimation (i.e., Wiener-Kolmogorov) setting which incorporates filtering, prediction, and smoothing as special cases [9]. Also a general class of such problems has been treated by considering spectral uncertainty classes of a general type generated by Choquet capacities. This latter work includes a study of minimax smoothers for such models [5], an extension of the underlying capacity theory which allows for the expansion of the utility of such models [7], and a demonstration that the commonly-used p-point spectral uncertainty class is of this type [8].
Other work conducted during this reporting period includes: the preparation of three invited survey papers and presentations on various aspects of the robustness results which have been developed in part under this support [2], [15], [19]; a study of the solution to a minimax problem arising in jammer design [1], [12]; an investigation of robust matched filtering for observed point processes [13], [14]; and a study of an alternative to minimax design that is useful for parametric hypothesis-testing problems [3], [16].

A. Journal Articles


B. Conference Papers


* invited paper


C. Theses and Reports


*invited papers