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MATHEMATICAL TECHNIQUES FOR NONLINEAR SYSTEM THEORY.(U)
MAY 79 R E KALMAN , E EMRE

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The main topic of research concerned various algebraic characterizations of $F \text{ mod } G$ invariant subspaces in linear systems. Module-theoretic characterizations of these subspaces were obtained which showed among other results, that a module structure can be defined maximally on the ratio of V to R where V is the maximal $F \text{ mod } G$ invariant subspace contained in the Kernel of H and R is the analogous maximal reachability subspace. A final solution of the so-called partial realization problem was obtained.

Grant AFOSR 76-3034

May 1979

Mathematical Techniques For Nonlinear System Theory

During the past year, the major effort under this grant was work by the Principal Investigator (R. E. Kalman) and by E. Emre (Postdoctoral Research Associate, partially supported under the grant).

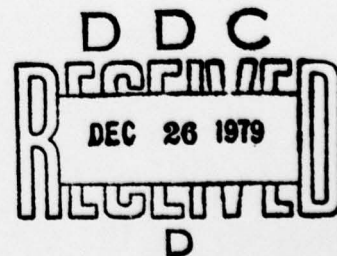
The main topic of interest concerned various algebraic characterizations of $F \bmod G$ invariant subspaces in linear systems (in the sense of Basile and Wonham). For example, in joint work with M. Hautus (Eindhoven Technological University, NETHERLANDS), Emre obtained an explicit characterization using the representation of the transfer matrix in the form $D^{-1}N$. At about the same time, the Principal Investigator obtained module-theoretic characterizations of these subspaces showing, among other results, that a module structure can be defined maximally on $V_{\max}/R_{\max}$, where $V_{\max}$ is the maximal $F \bmod G$ invariant subspace contained in the kernel of H and $R_{\max}$ is the analogous maximal reachability subspace. (Here, as usual, (F, G, H) are the defining matrices of the linear system in question.)

While these results may at first sight appear to be rather technical, they are necessary and very important in order to understand the theory of such subspaces and answer questions related to practical applications. Several papers are now being prepared for publication; these will be reviewed in full in December 1979 in the next renewal proposal.

Emre and Kalman attended the NATO Summer School on Geometric Methods in System Theory (Harvard University) and gave invited lectures presenting some of these results.

Very recently, the Principal Investigator obtained the final solution of the so-called partial realization problem; the writeup of this work is proceeding and will be completed by the end of the year.

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