RESEARCH ANNOUNCEMENTS

The purpose of this department is to provide early announcement of significant new results, with some indications of proof. Although ordinarily a research announcement should be a brief summary of a paper to be published in full elsewhere, papers giving complete proofs of results of exceptional interest are also solicited. Manuscripts more than eight typewritten double spaced pages long will not be considered as acceptable.

LEARNING AND ENERGY-ENTROPY DEPENDENCE IN SOME NONLINEAR FUNCTIONAL-DIFFERENTIAL SYSTEMS

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Communicated by Gian-Carlo Rota, July 14, 1969

1. **Introduction.** This note describes limiting and oscillatory features of some nonlinear functional-differential systems having applications in learning and nonstationary prediction theory. The main results discuss systems of the form

$$\dot{x}_i(t) = A(W_t, t)x_i(t) + \sum_{k\in J} B_k(W_t, t)z_{ki}(t) + C_i(t) \tag{1}$$

and

$$\dot{z}_{ji}(t) = D_j(W_t, t)z_{ji}(t) + E_j(W_t, t)x_i(t), \tag{2}$$

where $i\in I, j\in J$, and I and J are finite sets of indices such that either $I=J$ or $I\cap J=\varnothing$. The coefficients are continuous functions of t, dependent perhaps on the $|I|(1+|J|)$ dimensional vector function $W=(x_i,z_{ji}: i\in I, j\in J)$ evaluated at times no later than t, and on known functions of t. All coefficients B_j and E_j are also nonnegative, and the initial data and inputs C_i are nonnegative and continuous. The main results discuss the probabilities $y_{ji}(t)=z_{ji}(t)\left[\sum_{k\in I}z_{jk}(t)\right]^{-1}$ and $X_i(t)=x_i(t)\left[\sum_{k\in I}x_k(t)\right]^{-1}$ defined for $i\in I$ and $j\in J$, given choices of initial data and coefficient functionals for which (1) and (2) has a unique bounded solution.

These results apply for example to systems of the form

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[1] The preparation of this work was supported in part by the National Science Foundation (GP 9003), the Office of Naval Research (N00014-67-A-024-0016), and the A.P. Sloan Foundation.