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NASA TECH BRIEF

Chebyshev Minimax Control Theory

In a detailed study of Chebyshev Minimax (C-Minimax) control theory, general, closed-form, analytical solutions are determined for certain classes of C-Minimax control problems; several alternative mathematical theories are derived; and a controller design theory is developed to give optimal control in the presence of unmeasurable external disturbances. Results of this study may be applied to the design of control systems in many areas of technology, such as aircraft flight control, marine navigation through disturbances from ocean currents or atmospheric winds, control of interest rates in a business economy, allocation of raw materials among competing processes, or process control in the chemical and pharmaceutical industries.

The search for general solutions to certain classes of C-Minimax problems was successful, in the sense that several classes were solved explicitly. However, each solution contained some form of degeneracy, and the classes solved were not representative of the problems encountered in practical applications.

Several alternative formulations of C-Minimax problems were developed. These theories may lead to more effective computing techniques and will certainly permit a more rational approach to the design of simplified "almost optimal" C-Minimax controls. This domain involving approximate solutions to C-Minimax problems, will also be aided by the verification theorems developed, which can be used to test the degree of optimality of conjectured control laws.

The C-Minimax control problem in the discrete-time domain was formulated and solved. This has extended the range of C-Minimax theory to include problems in economics, operations research, and other areas where decisions are made in discrete steps.

The disturbance absorption theory, by which optimal feedback control may be achieved in the presence of unmeasurable external disturbances, is believed to be a new, highly important result in the theory of dynamic systems. The theory is particularly attractive because it results in solutions that can be implemented with available control hardware.

Note:

Requests for further information may be directed to:
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No patent action is contemplated by NASA.

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