August 1970

Brief 70-10309

NASA TECH BRIEF

Theory and Application of Kalman Filtering

Kalman filtering, a technique that develops a single sophisticated mathematical method from a series of restricted-function mathematical methods, should be of interest to designers of communications and control systems. As a unified extension of a group of related mathematical procedures such as Gaussian least squares, Markov's minimum variance, statistical estimation theory, and Wiener filtering, Kalman filtering could be of appreciable assistance in the design of aircraft- and ground-based guidance and navigation data reduction and display systems.

An investigation in depth, made in two parts, namely, theoretical aspects of Kalman filtering and the application of the Kalman filter, points up the potential usefulness of this design tool. The theoretical aspects of Kalman filtering are treated in a survey of the aforementioned related mathematical procedures and reduced to a single diagram, "interrelations among the Kalman filter development and derivations", which is a particularly useful guide for any study or review of filtering.

The application of the Kalman filter is mainly directed to nonlinear dynamic systems. Undergoing linearization, the framework of linear filtering in variational residue form is derived, following Battin's approach very closely. A step-by-step computational procedure of the Kalman-Battin filter is developed and adapted to several important application examples, in particular, to the problem of very complex trajectory determination. The same recursive estimation formulas, with few modifications, are applicable to data filtering and parameter estimation, for example, estimating the coefficients in error models and determining optimal weighting among models from various sources.

Note:

Requests for further information may be directed to:
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Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: L. Teng of
Sperry Rand Corporation
UNIVAC Division
under contract to
Marshall Space Flight Center
(MFS-20491)

Category 06