

Wiener analysis of nonlinear systems using Poisson-Charlier crosscorrelation

Biological Cybernetics

December 1977, Volume 27, Issue 4, pp 221–227

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Article

Received:

14 July 1977

DOI (Digital Object Identifier): 10.1007/BF00344143

Cite this article as:

Kroeker, J.P. Biol. Cybernetics (1977) 27: 221. doi:10.1007/BF00344143

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Abstract

Nonlinear systems with event-sequence input, such as are often encountered in neurophysiology, may be experimentally tested with all possible input sequences by stimulation with a Poisson process eventsequence. A complete predictive model of the system's response may be constructed from this data with the Wiener expansion based on the Poisson-Charlier polynomials. Here it is shown how this formulation leads to an efficient method for the evaluation of unknown systems by crosscorrelation, generalizing previous methods. The basic statistical properties of the procedure are demonstrated and the length of experiment required for accurate estimation of the model is computed. The procedure is translated into digital algorithms and the analogous procedures for white noise analysis are presented.

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- Print ISSN 0340-1200
- Online ISSN 1432-0770
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