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University of South Florida

FINAL REPORT

Research Accomplishments

During 1979-80 Under Contract

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*The Development of Some Stochastic Models
of Mathematical Sciences*

The research accomplishments under the present contract fall in three areas of mathematical sciences. These areas are in nonparametric probability estimation, environmental problems, and reliability modelings.

Utilizing the theory of sample characteristics functions and the Fourier representation of the kernel estimator, we have derived rates of convergence for kernel estimators in a large class of Hilbert spaces.

Preliminary results have been obtained on two unresolved problems in the area of penalized maximum-likelihood estimators. The first problem we dealt with is developing the consistency conditions of such estimators. The second accomplishment was the development of an objective criterion for choosing a smoothness parameter.

Kernel estimators of a probability density function with variable bandwidths that depend on the distance to the first through n^{th} neighbors of the point in question were studied. The asymptotic properties and rates of convergence of these types of bandwidths were obtained .

A deterministic model that involves the phytoplankton production in a marine ecosystem was developed along with its stochastic analysis.

A nutrient limited model for phytoplankton production was simulated and the mean behavior of the random process as well as the variance and correlation structure were studied.

The Gompertz probability distribution was studied as a reliability failure model. Estimation of its parameters can not be obtained in closed form. A numerical procedure has been developed to obtain acceptable estimates of the parameter. Also, other forms such as the Makeham-Gompertz distribution were studied.

The following papers were written:

- 1) Recent Developments in Nonparametric Estimation of Probability Density, Stochastic Systems, Academic Press, N.Y., N.Y., with A. Rust.
- 2) Nonparametric Estimation of Probability Density Function, submitted, with A. Rust.
- 3) On Maximum-Penalized Likelihood Estimators, submitted, with A. Rust.

- 4) Developments in Nonparametric Density Estimation Methods, Internal Statistics Institute, with S. Bean.
- 5) Variable Kernel Estimates of a Probability Density Function, submitted, with S. Bean.
- 6) Phytoplankton Modeling Involving Random Rate Constants, Part I: International Journal of Environmental Studies, with R. Jernigan.
- 7) Phytoplankton Modeling Involving Random Rate Constants, Part II: International Journal of Environmental Studies, with R. Jernigan.
- 8) A Linear Stochastic Model for Phytoplankton Production in a Marine Ecosystem, Journal of Ecological Modeling, with R. Jernigan.
- 9) Simulation of a Nonlinear Stochastic Ecology Model, Journal of Applied Mathematics and Computation, with R. Jernigan.
- 10) Maximum Likelihood Estimators of Bivariate Distribution with Monotone Failure Rates, with A.N.V. Rao.