

**North Carolina State University
Operations Research Graduate Program
OR 601/801**

**Tuesday, February 6, 2007
Daniels Hall Room 406
4:30 p.m.**

Optimal Control of Populations Using Impulsive Culling

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Abstract

Assume the population density is modeled by Fick's law, has time delays and growth rates similar to the logistic model. The population will be culled by a discrete number of "traps" with variable locations and intensities, which are to be the controls. The culling is modeled by a linear combination of products of delta functionals and population densities. The objective is to reduce the population density to an "acceptable" level in "most" of the domain and in "suitable" time. Numerical solutions of the state equation, which is a nonlinear PDE with weak solutions, will be described and include explicit, semi-linear SOR and Newton methods. The controllability to a zero population density is related to the principle eigenvalue of a linear operator (either the linear part of the PDE or the coefficient matrix of the discrete model) and the population growth rates. The Levenberg-Marquardt algorithm will be used to solve the optimal controls for the variable intensities. Simulated annealing will be used to find the optimal locations of the culling sites.

Refreshments will be served in 401 Daniels Hall at 4:00 p.m.