An Optimal Control Problem Related to a Hybrid Aquatic System

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The increasing interest for ecological water quality models has gained a lot of importance during the last few decades and has arisen as a result of the eutrophication of lakes and reservoirs throughout the world.

In this talk, we consider the analysis and numerical implementation of an optimal control problem associated with a nutrient-phytoplankton-zooplankton-fish model introduced in [2]. In this model, the parameter for nutrient level and fish predation acts as a distributed control variable. A similar optimal control problem, but slightly different from this approach with respect to the grazing rate of zooplankton on phytoplankton, was treated in [1].

We establish the existence of optimal solutions and derive the optimality system. We also provide some numerical simulations that support the theoretical results.

References

[1] M.R. Garvie, C. Trenchea, *Optimal control of a nutrient-phytoplankton-zooplankton-fish system*, SIAM J. Control Optim. **46**(3) (2007) 775–791.

[2] R.K. Upadhyay, N.K. Thakur, *Nonlinear Non-equilibrium pattern formation in a spatial aquatic system: effect of fish predation*, J. Biol. Systems **18**(1) (2010) 129–159.