Optimal Harvesting Modelling

Report 1

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Abstract

Contents

1 Preliminary Concept

1.1 Constrained minimization in Banach spaces and Lagrange multipliers

Definition 1. Lower semi-continuous A functional F is lower-semicontinuous if

$$F\left(\lim_{n\to\infty} x_n\right) \leq \liminf_{n\to\infty} F(x_n) \tag{1.1}$$

Definition 2. Derivative. The functional F on a Banach space i

Let X, Y, U be Hilbert spaces and Z be a Hilbert lattice. Consider the constrained minimization problem:

$$\min_{x\in C} J(x)$$

subject to

$$E(x) = 0$$
$$\text{and}$$
$$G(x) \leq 0$$

Where C is a closed and convex set in X, $J : X \to \mathbb{R}$, $E : X \to Y$, and $G : X \to Z$ are continuously differentiable

1.2 Control Problem

3 Deterministic Model.

3.1 Logistic Equation.

3.2 Optimization problem.

$$\min_{u \in U_{\text{ad}}} J(u) = \frac{1}{2} \|y - y_0\|^2_{L^2(\Omega)} + \frac{\alpha}{2} \|u\|^2_{L^2(\Omega)} \tag{P}$$

subject to,

$$-Ay + \phi(y) = u \quad \text{in } \Omega, \tag{3.1}$$
$$y = 0 \quad \text{on } \delta\Omega \tag{3.2}$$

and the pointwise constraints,

$$u_a \leq u(x) \leq u_b \quad \text{for almost every } x \in \Omega, \tag{3.3}$$
$$y_a(x) \leq y(x) \leq y_b(x) \quad \forall x \in K \subset \Omega, \tag{3.4}$$

3.2.1 Optimal Control.

3.2.2 Error Analysis.

4 Optimizing Algorithms and Simulation.

4.0.1 Algorithm.

4.0.2