

**PARABOLIC PROBLEMS WITH PARAMETER OCCURING IN
ENVIRONMENTAL ENGINEERING**

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Abstract

In this work, the uniform well posedness of singular perturbation problems for parameter dependent parabolic differential-operator equations are obtained. These problems occur in phytoremediation modelling.

Key Word: Singular perturbation, Initial value problems; Differential-operator equations; Abstract parabolic equation; Interpolation of Banach spaces; Semigroups of operators; phytoremediation modelling

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1. Introduction

Remediation techniques have been based on either immobilization, extraction by physico-chemical methods, landholding, or burial. These methods often have some shortcomings: requiring special equipment, expensive, can remove biological activity from the soil, and can importantly affect the soil physical properties.

The model describing in this project is developed in three parts. First, the dynamic portion will be developed using a reaction-diffusion system. Next, the cost function will involve the dynamic state variables and finally the desired EPA target will be defined as a mathematical property. Assume $u_1(t, x)$, $u_2(t, x)$, $u_3(t, x)$ are amounts of heavy metal in the environment in the roots and in the shoots at t months on $x = (x_1, x_2, x_3)$ place, respectively. Since the plant-toxicant interaction dynamic occurs during a harvest season, we need to describe the process one harvest cycle. The initial amount of metal in different harvest cycles depends on what is remaining in the soil at the end of the cycle. The mathematical description of this process can be obtained as the following initial value problem (IVP) for systems of delay parabolic equations with parameter

$$s \frac{\partial u_i}{\partial t} + \sum_{j=1}^3 b_j(s, t) u_j(t - \sigma_j, x) = f_i(t, x), \quad 0 < t \leq T,$$

$$u_i(t, x) = g_i(t, x), \quad -\sigma_j \leq t \leq 0, \quad x \in [a, b], \quad i, j = 1, 2, 3.$$