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Numerical Approximation of the Exact Control for the Vibrating Rod with Improvement of the Final Error by Particle Swarm Optimization

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Abstract: The paper studies the numerical approximation of the exact boundary controllability for the vibrating rod by the Hilbert uniqueness method (HUM). This study is based on the knowledge of the asymptotic behavior of the control governing the system at time T. This is the idea developed in this work concerning the Dirichlet boundary case. More precisely, an approximate control shall be found which returns the system under consideration to rest at time T with an estimation of the final state error and the improvement of it by using the particle swarm optimization algorithm (PSO).

Keywords: *exact controllability; vibrating rod; Hilbert uniqueness method; asymptotic behavior; Dirichlet control; particle swarm optimization.*

Mathematics Subject Classification (2010): 93B05, 74K10, 65K10, 65N25, 65M06, 78M32.

1 Introduction

Controllability is a classical problem in control theory. The idea that motivated this work is that control theory is certainly, at present, one of the most interdisciplinary areas of research. It is nowadays a rich crossing point of engineering and mathematics. Many problems of control theory such as optimal control and stabilizability may be solved under assumption that the system is controllable, see [9,16,19]. Controllability means that it is possible to drive a dynamic system from an arbitrary initial state to an arbitrary

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