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# APPROXIMATED CONTROLLABILITY OF THE STRONGLY DAMPED IMPULSIVE SEMILINEAR WAVE EQUATION WITH MEMORY AND DELAY

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**ABSTRACT.** This article studies the interior approximated controllability of the strongly damped semilinear wave equation with memory, impulses and delay terms. The problem is challenging since the state equation contains memory and impulsive terms yielding to potential unbounded control sequences when steering the system to a neighborhood of the final state, thus fixed point theorems cannot be used directly. As alternative, the A.E Bashirov and et al. techniques are applied and together with the delay allowing the control solution to be directed to fixed curve in a short time interval and achieve our result.

## 1. INTRODUCTION

Research of control systems has been motivated not only by engineering practices but also by biological process, aiming to improve manufacturing processes, energy use efficiency, biomedical experimentation, diagnosis, robotics, biological control systems among others. And surprisingly, it has become of great interest in the social, political and economic spheres for understanding of the dynamics of business, social, and political systems.

Generally speaking, control theory tackles how the behavior of a systems can be modified through feedback, specifically, how an arbitrary initial state can be directed either exactly or approximated close to a given final state using a set of admissible controls. Moreover, the controllability of a system is expected to be a robust property, meaning that, if the system dynamics is controllable, all modes of the system can be perturbed from the input and inherent phenomena such as abrupt changes, delays and dependance on prior behavior would not modify the controllability of the system. Thus, the conjecture is that controllability of a system will not change due to perturbations corresponding to delays, impulses or some type of memories.

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*Key words and phrases.* Semilinear strongly damped wave equation, impulses, memory, delay, approximate controllability, strongly continuous semigroups.

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