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Short communication

# Position control of double-side impact oscillator

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**Abstract**

Position control of impact oscillator under asymmetric double-side endstops is considered. The results show that the stable or unstable (chaotic) impact oscillators can be controlled and kept in a desired position. The proposed method is based on a feedback control force and the algorithm shows a fast convergence rate.


*Keywords:* Position control; Impact oscillator; Feedback control

## 1. Introduction

Impact dynamics is considered to be one of the most important problems which arise in vibrating systems. Such an impact oscillator occurs in the motion with amplitude constraining stop. In the past years, this model has found rich phenomena and given benefit for understanding of impact systems [1–6]. Different types of impacting response, such as periodic and non-periodic (chaotic) oscillations, were predicted by using bifurcation diagrams. In this paper, control of impact oscillator is considered.

The idea of controlling chaos was first introduced by Ott et al. [7] and has been successfully applied to vibro-impact systems [8–10]. The unstable periodic motion can be stabilized by applying a small and precise perturbation on an available control parameter. The impact dynamics control was also studied using delay feedback by Awrejcewics et al. [11] and displacement feedback by Gutierrez and Arrowsmith [12]. In this paper, position control of asymmetric double-side impact oscillator with a feedback control force is studied.

The structure of this paper is as follows: In Section 2, the mathematical model of impact oscillator is introduced. In Section 3, the algorithm of position control of impact oscillator is developed. The numerical simulations are demonstrated in Section 4 and the conclusions are addressed in Section 5.

## 2. System description

In pressurized systems, steam generator tubes are designed to have clearances at support points to allow for thermal expansion and when fluids flow through these tubes, bubbles occur, and the tubes experience

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an excitation, see Fig. 1. The responses of such systems are complicated and the wear of these tubes are the major problems. For simplification, this physical model is considered as a double-side impacting system of Fig. 2.

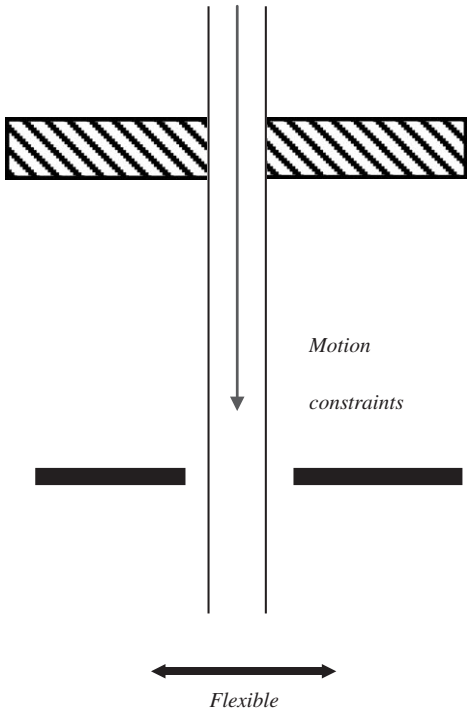


Fig. 1. Pipe and tube vibration system.

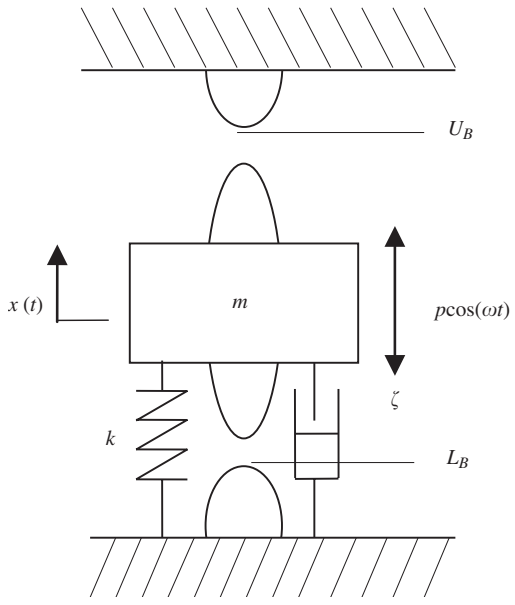


Fig. 2. Double-side endstops impact oscillator.