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Modeling of dynamical systems with friction between randomly rough surfaces

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Abstract

Friction induced vibrations are present in many engineering systems, e.g. in brakes and cam follower systems. In these systems, self-excited oscillations may occur. Surface roughness is an important source of uncertainty in friction systems. The aim of this contribution is to study the influence of surface roughness on friction induced vibrations. To this end, a statistical analysis of measured rough surfaces is carried out in order to generate statistical representative surfaces. Following the Bowden-Tabor approach, the friction coefficient of these surfaces is computed and represented by a stochastic process. As an example, the classical mass on a belt system is considered, where stick-slip vibrations occur. A stochastic process is introduced into the model and its influence on the limit cycle is studied. It is shown that the stochastic nature of the friction coefficient is non-Gaussian and that it alters the stick-slip limit cycle.

Keywords: Friction-induced vibrations, Surface Roughness, Polynomial Chaos, Non-Normal Distributions

1. Introduction

Dry friction between rough surfaces is present in many engineering systems and noise due to friction induced self-excitation is a common problem e.g. in brake systems. Friction induced vibrations have been extensively studied. How-

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