NUMERICAL IMPLEMENTATION OF ROUGHNESS EFFECTS ON FRICTION-INDUCED VIBRATIONS

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ABSTRACT

Friction-induced vibrations have been deeply addressed in literature both numerically and experimentally [1]. The interest in this issue arises from the complex nature of friction dynamics, which is the cause of multiple mechanical phenomenon, such as brake squeal [2], stick-slip [3] and wear [4]. The reproduction of the dynamic response to the contact excitation has been always a challenge, because of the several parameters that interact in the contact dynamic. In this framework, the object of this study is to analyze and reproduce the contact dynamic response of a system composed by two beams in overall frictional sliding.

The approach to simulate the effects of roughness on friction-induced vibrations is based on the implementation of a friction coefficient composed by two terms: a constant one, as for the Coulomb law, and a perturbative term, to introduce an equivalent broad band excitation by the contact:

$$\mu = \mu_{const} + \mu_{perturbative} = \mu_{const} + A|v(t)|^{b} R(x)$$

In order to validate the contact law, the perturbative term *R(x)* has been retrieved experimentally by inverse methods.

The proposed method has the dual purpose to correctly reproduce the friction-induced vibrations and to save computing time, which undergoes an unacceptable increase when introducing the surface roughness within a finite element model.

A parametrical analysis has been carried with respect to the normal load, the sliding velocity and the surface roughness.
The numerical results from the proposed method have been validated by comparison with the experimental measurements, showing a good correspondence between the experimental and the numerical results.

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