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Some Remarks On Experimental Analysis Of A Non-Ideal Conveyor Belt.

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Abstract: The conveyor belt is an important equipment of the preparation system in sugar and alcohol plants. It is responsible for providing the mills with constant feeding of sugar cane mass, avoiding overloads due to excessive feeding. This work aims to develop a small-scale experimental setup of the conveyor belt, which can reproduce its behavior, and thus be able to implement modifications to validate theoretical studies.

Keywords: non-ideal machinery, conveyor belt dynamics, Sommerfeld effect, nonlinear dynamics

1. Introduction

The sugar cane grinding depends on equipment specially designed to receive and prepare the raw material in order to obtain maximum production efficiency. As the last segment of a long equipment's line the conveyor belt depicted in Fig.1(a) is the most important element to keep the feeding constant for the grinding process.

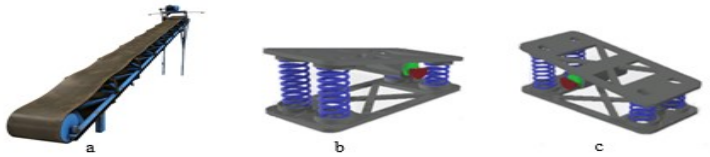

Fig. 1. 3D Model of Conveyor Belt and Apparatus Developed (a: [3]; b, c: Elaborated by the authors).

The experimental setup consists of the lower base connected to the upper base by two pairs of springs of different lengths, as described in Fig.1(b) and Fig.1(c), in order to have the inclination shown in the real equipment. A 9V DC motor was connected on the upper base and its speed control was done by Arduino. The motor speed was measured using an LM393 (optical photosensitive light sensor module) and the Arduino was also responsible data acquisition. Additionally, to acquire the vibration data, the accelerometer of the iPhone 6 cell phone was used, as depicted in Fig.2. Because of the dynamic interaction and energy transfer between the vibration modes of the apparatus when

excited by an unbalanced motor, its torque does not remain constant, which characterizes the motor as non-ideal [1, 2].

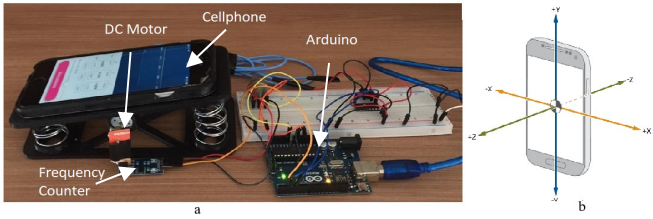

Fig. 2. Equipment's Used in Experience and Accelerometer Coordinates (a: Elaborated by the authors; b: [4]).

2. Results and Discussion

The experimental results showed movements of pitch, roll and bounce, as represented in Fig.3, for which it was observed the Sommerfeld effect [1]. This phenomenon occurs in unbalanced rotating machines supported by flexible structures where power is converted into mechanical vibration instead of increasing the machine rotation speed.

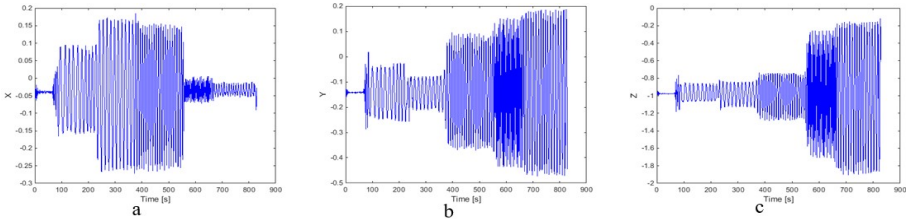

Fig. 3. Time Histories in Physical Coordinates for Conveyor (a) Roll (b) Pitch and (c) Bounce.

3. Concluding Remarks

Experience has shown that on the x-axis, rotation around the longitudinal, the frequency has stagnated although during the experiment the angular velocity continued to increase. There is an increase in the amplitude of vibration in the frequency range of capture near the resonance frequency and then a jump to a higher frequency with lower vibrations. Future results include the exploration of vibration modes and numerical results of mathematical modeling [1, 2].

References

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