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”DYN2#3 - Rubber part characterisation for rotordynamics analysis.”

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Abstract. This paper presents a method to determine stiffness dynamic characteristics of rubber parts which are used for vibration isolation. The study was motivated by the need of such characteristics to model vibroflot’s dynamic behaviour. Vibroflots are used by ground improvement companies to deeply densify sandy soils by vibrations in order to make stable future infrastructures. A classical vibroflot is a slender structure hung from a crane with several extension tubes and cables. The vibroflot is composed of a non-rotating tube casing in contact with the soil, containing a mass unbalanced rotor mounted on rolling bearings driven by an asynchronous electrical motor that produces orbital vibration and therefore the soil compaction. In order to avoid the vibrations to propagate to the extension tubes two big rubber coupling parts are used. The method presented here is based on five steps. The first step aims at determining material properties and at presenting the hyper-elastic and viscoelastic models used [1, 2]. Then real dynamic tests are carried out on one type of rubber coupling, at different frequencies and dynamic amplitudes, using a hydraulic shaker capable to develop a force up to 62 kN. Then Finite Elements simulations are conducted to validate material models and parameters on the first geometry. Once the results are satisfactory, simulations are made on the second rubber coupling made of the same material. Finally, both rubber parts stiffness properties are known for different sets of parameters and can be introduced into the global Finite Elements multi-rotors model for investigating operational runs. Keywords: Rotordynamics, Rubber characterization, Vibration isolation, Vibroflot. References 1. G. A. Holzapfel, Nonlinear Solid Mechanics: A Continuum Approach for Engineering, Chichester, England: Wiley, 2000. 2. G. Petitet and M. Barquins, Matériaux caoutchouteux, Lausanne, Switzerland: PPUR, 2008.

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