Discovery Of Avoided Crossings In Plate Vibrations By Using COMSOL

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Abstract

We have recently published the discovery of avoided crossings present in the spectrum of freely vibrating rectangular thin plates(1). In this poster we show how the Structural Mechanics module of COMSOL Multiphysics was a fundamental tool to accomplish this feat, by easily generating normal modes and classifying them into symmetrical and anti-symmetrical modes, we found avoiding crossings in each symmetry sector when we vary the length of the rectangular plate. We also explain the relationship amongst this phenomenon and the theory of random matrices in Wave-Chaos studies. The understanding of free vibrations has been an open problem for more than two hundred years and now, with the development of the aerospace industry, its characterization becomes more important. Since our working hypothesis is that these avoided crossings are caused by the presence of evanescent waves traveling at the system´s boundary, we present preliminary results of the appearance of this phenomenon in a freely vibrating disk sector when we vary its angle. We conclude this work with the proposal to investigate further the phenomenon, again with the help of COMSOL, by relating the spectral variation parameter with some multi-physics property that might affect the system.

Reference

(1) J.L., López-González, et al. "Deviations from Poisson statistics in the spectra of free rectangular thin plates," Phys. Rev. E 103, 043004 1-7 (2021)

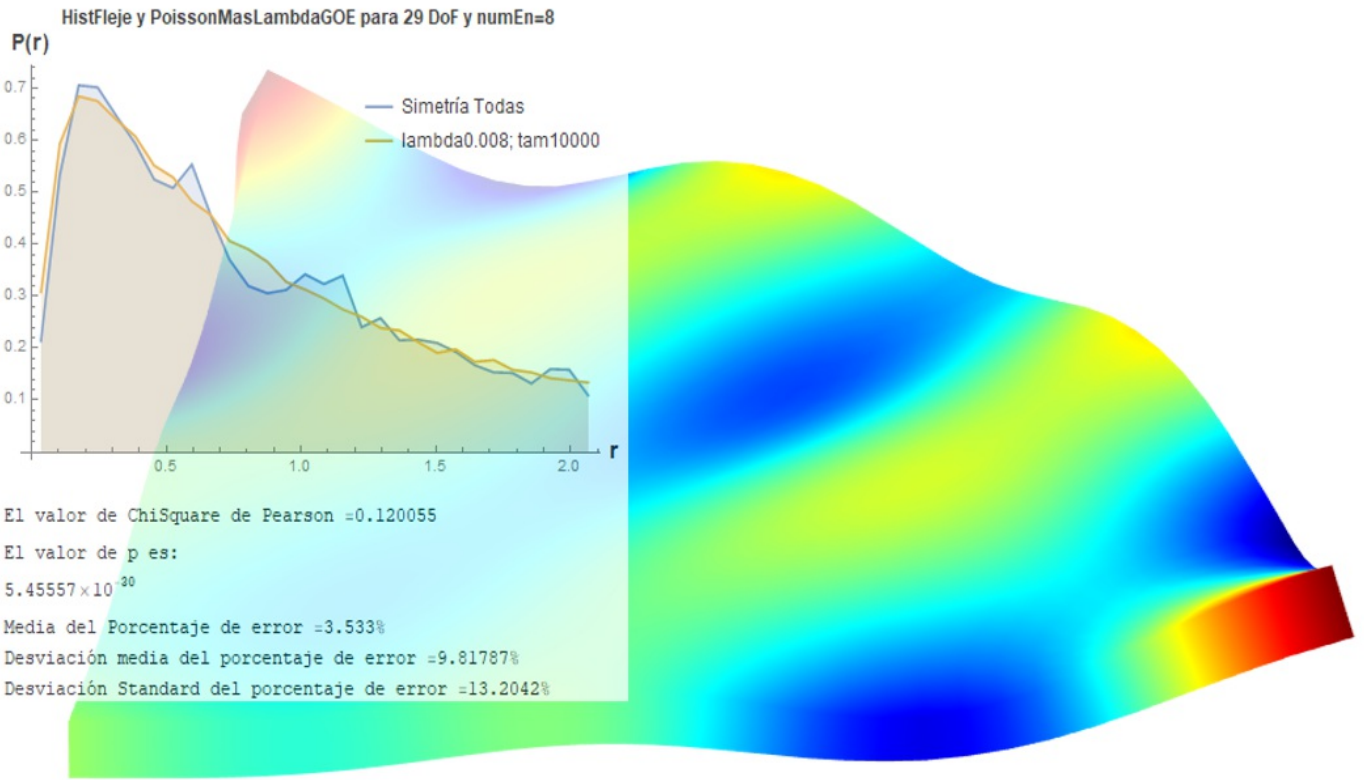## Figures used in the abstract

Figure 1 : Histogram of the two symmetry classes of an ensamble, of 8000 normal modes for the free disk sector, obtained by varying its angle; also it is shown a sample of a normal mode for the disk sector.
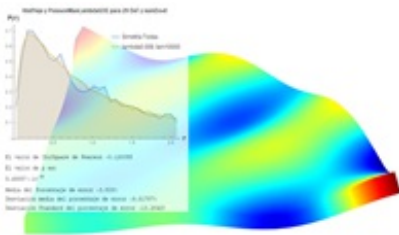

Figure 2 : Thumbnail