

## Portuguese Guitar Strings Characterization and Comparison

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**Abstract :** The characteristic sonority of the Portuguese guitar is in great part what makes Fado so distinguishable from other traditional song styles. The Portuguese guitar is a pear-shaped plucked chordophone with six courses of double strings. This study compares the two types of plain strings available for Portuguese guitar and used by the musicians. One is stainless steel spring wire, the other is high carbon spring steel (music wire). Some musicians mention noticeable differences in sound quality between these two string materials, such as a little more brightness and sustain in the steel strings. Experimental tests were performed to characterize string tension at pitch; mechanical strength and tuning stability using the universal testing machine; dimensional control and chemical composition analysis using the scanning electron microscope. The string dynamical behaviour characterization experiments, including frequency response, inharmonicity, transient response, damping phenomena and were made in a monochord test set-up designed and built in-house. Damping factor was determined for the fundamental frequency. As musicians are able to detect very small damping differences, an accurate a characterization of the damping phenomena for all harmonics was necessary. With that purpose, another improved monochord was set and a new system identification methodology applied. Due to the complexity of this task several adjustments were necessary until obtaining good experimental data. In a few cases, dynamical tests were repeated to detect any evolution in damping parameters after break-in period when according to players experience a new string sounds gradually less dull until reaching the typically brilliant timbre. Finally, each set of strings was played on one guitar by a distinguished player and recorded. The recordings which include individual notes, scales, chords and a study piece, will be analysed to potentially characterize timbre variations.

**Keywords :** damping factor, music wire, portuguese guitar, string dynamics

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