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# TREE VIBRATIONS: DETERMINING OSCILLATORY PROPERTIES BY USING INFRA-RED MARKER-TRACKING SYSTEM

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## Highlights

- A state-of-the-art motion tracking system with markers is used to record free vibrations of a potted tree
- In-plane damped beating oscillations are recorded both for the tree in-leaf and out-of-leaf
- Main oscillatory characteristics are explained and calculated
- Among them are: principal axes, two natural frequencies and two damping ratios.

## Abstract:

A state-of-the-art infrared marker-tracking system that consists of eight cameras outfitted with infra-red optical filters and an array of infra-red light-emitting diodes as well as a set of reflective markers, is used to record the motion of a set of markers arranged along a trunk-dominated potted tree, which was pulled and released to perform free vibrations. The time-history diagrams of these markers are numerically fitted to the corresponding analytical mathematical model for each marker, in which the markers are treated as particles performing in-plane oscillations. This combination of experimental, analytical and numerical results yields the main vibration properties of the markers, i.e. the points on the tree: natural frequencies, damping ratios and the position of principal axes in two cases: for the in-leaf and out-of-leaf tree under consideration. The shape of the time history diagrams for the motion along one direction indicates the initial increase of the amplitude, and this property is found

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