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The Use of Ultrasonic Tomography for the Non-destructive Assessment of Tree Trunks

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Assessing internal decay in tree trunks can be of crucial importance for industrial, environmental and public safety reasons [1]. To this effect, non-destructive testing (NDT) methods can provide information on the structural condition of trees with minimum intrusion. In this work, authors have analysed the capabilities of ultrasonic tomography in evaluating the internal structure of living trees, with a special focus on the identification of internal decay areas and tree bark inclusions.

The presented ultrasonic tomography provides an image of the distribution of the ultrasonic velocity of propagation within the investigated section of a mature horse chestnut (*Aesculus hippocastanum*). This technique has proven its viability to detect fungal decomposition [2]. However, there exist some open issues with regard to: a) the coupling of the transducers to the tree, b) the anisotropy of the wood, c) the signal attenuation and the resolution of the tomographic inversion. To overcome these challenges, research is underway to explore the integration and new data-fusion strategies with other NDT methods, such as ground penetrating radar (GPR), which have proven their effectiveness within this area of endeavour [3].

Within this context, data have been obtained from a "diseased" horse chestnut tree located at the Kensington Gardens – The Royal Parks – in London, UK, using two different ultrasonic equipment, i.e., the PICUS Sonic Tomograph and the Arbotom Sonic Tomograph. After compilation of data, the tree was felled and cut at the two sections where ultrasonic tomography tests were performed. In more detail, 12 sensors were arranged around the perimeter of the tree in compliance with the manufacturer's recommendations concerning the inspection methodology (sensors installed within the bark of the tree without any intrusion to the core of the tree). The adopted methodology takes to account the shape and size of the trunk [1]. The processed data were mapped against the cut sections of the tree for validity purposes.

Results presented in this abstract are part of a major ongoing research project that the authors have undertaken for the last three years.

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