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GPR and Microwave Tomography for the Assessment of Hollowed Tree Trunks

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The danger related to the structural stability of hollowed trees is a matter of wide discussion among the scientific community. Hollow cores in trees can extend to more than 50% of the total diameter [1] and, while the presence of a hollow tree might appear dramatic in terms of public safety, it is not always a cause of concern. It is known that hollow trees can form in many years or even decades [2] and, although the heartwood is effectively dead, the tree can continue to form sapwood on the exterior of the trunk to create a cylinder. However, robustness and structural support provided by this cylinder to the trunk and canopy above depend on the ratio of healthy to diseased tissue.

In this context, Ground Penetrating Radar (GPR) has proven to be an effective non-invasive tool, capable of generating information about the inner structure of tree trunks in terms of existence, location, and geometry of defects [3], [4]. Nevertheless, it had been observed that the currently available and known GPR-related processing and data interpretation methods and tools are able to provide only limited information on the tree inner structure.

In this study, we present a microwave tomographic approach for improved GPR data processing with the aim of detecting and characterising the geometry of hollowed trees. Tests were performed at Gunnesbury Park, London, UK. In particular, a number of 15 circular measurements were collected around the tree using the Aladdin 2 GHz hand-held antenna system manufactured by IDS GeoRadar (Part of Hexagon), covering a height of 140 cm. The tree was eventually felled and three sections were cut for validation purposes.

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

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