

ABSTRACT

Trees are one of the most useful plants for life on earth. A thesis from the Davey Institute and the US Department of Forestry found that one of the functions of urban trees is to clean the air from foul particles. But behind its beneficial function, trees are also at risk of harming us or our environment because the stem section often experience porousness that cannot be identified directly by sight alone. Rapid detection is needed to prevent several losses that may arise due to fallen trees.

This thesis identifies a hollow and non-hollow tree stem section with a sub surface detection radar system. The sub surface detection radar system is modeled using a Vector Network Analyzer (VNA) connected to a Vivaldi antenna. VNA will emit electromagnetic waves to the tree stem section. Electromagnetic waves will propagate and penetrate hollow tree stem section and then the propagation will meet the boundary plane between the wood and the cavity. This situation allows the reflection of electromagnetic waves. The antenna will catch the reflected wave and then display it by the VNA as S-Parameter. So the sub surface detection radar technique is needed to detect cavity in tree stemsection through reflected electromagnetic waves.

The test results of this research on radar modeling using VNA were made to show that the system can detect cavity in tree stemsection that works at a frequency of 1-8 GHz. The results of measuring cavity at one point can be identified the difference in signal. Another result is that the circular scanning method with inverse radon trasformation can identify wood with a diameter of 19 cm with a 6 cm and 9.5 cm diameter hole filled with water. The scheme of placing the antenna facing each other is the optimal scheme used in this research.

Keywords: *Radar, Vector Network Analyzer, Wood, Inverse Radon Transform*