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LUMBER MOISTURE MEASUREMENT USING A SIX-PORT REFLECTOMETER AND WAVEGUIDE APERTURE ARRAY

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ABSTRACT

This Thesis covers the development of a six-port and slotted waveguide based measurement system for the determination of the variation of moisture content (mc) of stacked lumber. A Six-port reflectometer was developed and used throughout the trials incorporating an automatic calibration system. This was implemented using switched coaxial standards, producing improvement in the long term stability of the six-port.

In addition the measurement of the dielectric properties of the typical lumber types of Heartwood, Sapwood and internal Branches is examined. Measurements were made using the waveguide cell technique covering the frequency range of 2.3 to 6.5GHz. Additional work was undertaken to establish a method to correct these measurements for variations in basic density and Earlywood \Latewood banding, giving rise to a potential moisture content estimation error of 0.63%.

Both an explicit first order model and multivariate regression analysis of the sensor was proposed and experimental results presented for lumber mc spanning the range of 10 to 180% by dry basis. From these trials a mc measurement error of 3% for the explicit model and 2% for regression of individual boards covering the sensor was determined without incorporating density effects.

Keywords: six-port, moisture content, lumber, permittivity

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