

## CORRELATION BETWEEN PARAMETERS ACOUSTICS AND STATICS IN ROUND WOOD.

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### Abstract

The use of logs in its original shape, as round timber, has been considered economically competitive and sustainable, making important the development of techniques that allow their classification. The objective of this research was to evaluate the correlation between acoustics (longitudinal velocity and stiffness coefficient) and statics (modulus of rupture and elasticity) parameters using round wood of *Eucalyptus grandis*. The results shows that there are statistically significant correlation of the acoustics and statics parameters in all condition analyzed, but the use of stiffness coefficient instead of only velocity of wave propagation can improve the correlation, mainly for the modulus of rupture.

*Key words: stiffness coefficient, modulus of elasticity, velocity of ultrasound wave.*

### Introduction

The use of logs in its original shape, as round timber, has been considered economically competitive and sustainable, making important the development of techniques that allow their classification. Significant savings could be obtained if there were an evaluation of wood quality before the sawing process and drying the logs<sup>1</sup>. It is expected that 80% to 90% quality measured by ultrasound in the logs will be kept in lumber<sup>2</sup>. Thus, the round wood classification is also interesting to the lumber industry as it increases the reliability of the mechanical performance of the beams.

The objective of this research was to evaluate, in round wood, the correlation between acoustics (longitudinal velocity in green condition and stiffness coefficient at equilibrium moisture content) and statics (modulus of rupture and elasticity) parameters obtained at equilibrium moisture content. For the tests we used 15 logs cut from 5 *Eucalyptus grandis* trees and 45 kHz transducers with flat and dry faces.

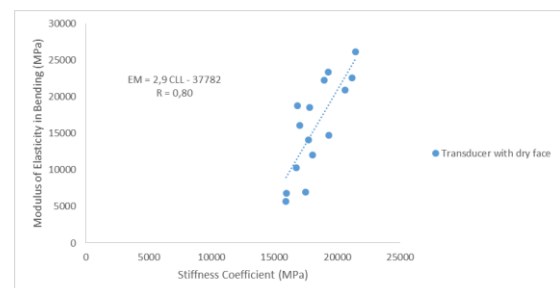
### Results and Discussion

There are a correlation statistically significant between longitudinal velocity ( $V_{LL}$ ) and modulus of elasticity ( $E_M$ ) and modulus of rupture ( $f_m$ ), for both transducers (Table 1). Considering the better – result,  $V_{LL}$  explain 61% of the variability of the  $E_M$  and 42% of the variability of the  $f_m$  (Table 1). Using the Stiffness coefficient ( $C_{LL} = \rho V_{LL}^2$ ), the introduction of the density ( $\rho$ ) allows to explain 64% of the  $E_M$  variability and 59% of  $f_m$  variability (Table 1). An example of the behavior of the data is presented using  $C_{LL} \times E_M$  (Figure 1).

**Table 1.** Correlation between longitudinal velocity ( $V_{LL}$ ) and stiffness coefficient ( $C_{LL}$ ) with modulus of elasticity ( $E_M$ ) and of rupture ( $f_m$ ) in bending.

	$V_{LLd}$	$V_{LLf}$	$C_{LLd}$	$C_{LLf}$
$E_M$	0.78 (0.0006)	0.75 (0.0014)	<b>0.80</b> <b>(0.0003)</b>	0.75 (0.0013)
$f_m$	0.62 (0.0147)	0.65 (0.0084)	<b>0.77</b> <b>(0.0008)</b>	0.75 (0.0009)

\* $V_{LLd}$  and  $C_{LLd}$  obtained using dry faces transducer and  $V_{LLp}$  and  $C_{LLp}$  flat face transducer.



**Figure 1.** Correlation between stiffness coefficient (CLL) and modulus of elasticity in bending (EM)

### Conclusions

There are a correlation statistically significant between the acoustics and statics parameters, but the use of stiffness coefficient instead of only velocity of wave propagation can improve the correlation, mainly for the modulus of rupture.

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<sup>1</sup> Kretschmann, D.; hernandez, R. 2006. Grading timber and glued structural members. Primary wood processing: principles and practice. Dordrecht, Springer: 339-390.

<sup>2</sup> Pelizan, T.R. 2004. Estudo de propriedades mecânicas de peças roliças de Eucalypto Citridora utilizando a técnica de ultra-som. São Carlos, SP: University of São Paulo. M.S. thesis.