Motivation
Wood is one of the oldest materials that still has not lost its importance in the construction industry. The objective of this study is to understand the behavior of timber as a construction material. And the influence of different parameters on its mechanical properties. Further, to simulate it under different loading scenarios with the help of commercially available software LS-Dyna. Which has a build-in, dedicated material model (MatWood-143) for wood. And finally, to validate the responses with available literature and testing data.

MatWood-143
Transversely isotropic:
Simplify the mechanical behaviour of wood to 2 directions, parallel to grains and perpendicular to grains. Only 5 independent elastic parameters are required.

\[ E_L, E_T = E_R, G_{LT} = G_{LR}, G_{TR} \text{ and } \nu_{LT} \]

Pre- and Post-peak hardening:
Wood shows considerable amount of hardening under compressive loads. That has been formulated through pre- and post-peak hardening parameters.

\[ N_i, N_L, c_i, c_L, G_{hard} \]

Post-peak softening:
Wood illustrates softening response under tensile and shearing loads. Which has been formulated through damage variables and fracture energies.

\[ D, d_{max}, G_{fI}, G_{fII}, B, d_{max}, G_{fI}, G_{fII} \]

Failure
• Parallel mode

\[ f_1 \geq 0 \]

\[ f_1 = \frac{\sigma_L^2}{X^2} + \frac{(\sigma_T^2 + \sigma_R^2)}{S^2} - 1 \text{ and } X = \begin{cases} X_T & \text{for } \sigma_L > 0 \\ X_C & \text{for } \sigma_L < 0 \end{cases} \]

• Perpendicular mode

\[ f_1 \geq 0 \]

\[ f_1 = \frac{(\sigma_T + \sigma_R)^2}{X^2} + \frac{(\sigma_T^2 - \sigma_T \sigma_R)}{S^2} - 1 \text{ and } Y = \begin{cases} Y_T & \text{for } \sigma_T + \sigma_R > 0 \\ Y_C & \text{for } \sigma_T + \sigma_R < 0 \end{cases} \]

Conclusion
• Material model working but has some limitations.
• With single element tests, all failure modes are observed.
• For large scale problem, like 4-PBT the failure mode has been captured with adjustment of hourglass energy, damping energy, loading time and mass scaling.
• For 3-PBT, no distinct perpendicular failure mode has been observed.
• More investigations are required before applying for anchoring applications.

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Numerical examples

Literatur