[Titrè de thése]
Beyond «clear wood»: Appearance, structure, physical-mechanical properties and anisotropy of figured woods with different patterns of grain deviations

[Lieu]
l'Amphithéâtre Jean-Jacques Moreau , 860 Rue de St - Priest, 34090 Montpellier Bât2 (labo LMGC)

[lien de Zoom]
https://umontpellier-fr.zoom.us/j/93630979840

[Date et heure]
13 éme juin, 14 h (fuseau horaire: Paris)

[Résumé]
The wood grain is not straight, and the singularity commonly exists in nature. Some trees frequently have specific grain patterns, causing their wood grain to deviate to the applying direction. The consequence is that those wood have the grain pattern and demonstrate an attractive appearance on the plane, called the figured wood. The definition of the figured wood is between the boundary of “common existence” and the “accidental occurrence”. The definition is thus defined by exploring their existence and lexical terms from the professional wood supply.
The hidden information about the attractive appearance is because of the diving angle. Thus, a trial with the visible light with multiple angles is made. Also, the analytical equation is built to approach their structure. Instead, the splitting along the radial direction demonstrates the grain structure in wood. Furthermore, some patterns, such as birdseye grain, have sudden grain changes against the radial direction. Pommele and swirling grain cannot be simulated or quantified. Besides the mesoscopic discovery for the grain structure, the XRD (X-ray diffraction) method is used for their grain angle (GA) and microfibril angle (MFA) local measurements.
Two dynamic mechanical (vibrational) methods were used for the longitudinal mechanical properties measurements in two sample sizes. Some new developments allowed testing dynamic properties in shear. A quasi-static test (ultrasonic) was used to expand to moduli in the other directions. The shrinkage properties and fibre saturation point (FSP) were measured to understand the hygro- mechanical properties and the relation to mechanical properties. Those properties values were compared with the literature results, comparing the relative difference. Reduced anisotropy was confirmed as a feature of figured woods.
Although figured woods are characterised by grain deviations, the longitudinal mechanical properties are not necessarily degraded, and between very different species, the MFA more dominates it. However, the grain deviations generally reduce the longitudinal modulus of elasticity, and the shear moduli are relatively large, causing smaller axial-to-shear anisotropy. Also, the anisotropy of properties appears more related to the MFA because it is more stable than the GA, which has very local variations for the complex grain structure. In the end, the visual grading from professional wood vendors is indirectly proving it because it helps compare the same species with different degrees of figure for the mechanical properties grading. However, the MFA is not detectable in macroscopic.
Keywords: woodcrafts, figured wood, visual grading, mechanical properties, structure-properties relationships, anisotropy.

[Jurys]

Rapporteur | M. Louis, DENAUD, Maître de conférences, Arts et Métiers, Cluny
Rapporteur | M. Nicola MACCHIONI, Directeur de recherche, CNR, Firenze, Italy
Examinatrice | Mme. Dominique LAFON-PHAM, Professeur, IMT Mines Alès
Examinateur | M. Jacques BEAUCHÊNE, Chercheur CIRAD, EcoFoG, Kourou
Examinateur | M. Joseph GRIL, Directeur de recherche CNRS, Institut Pascal, Clermont-Ferrand
Examinateur | M. Bernard THIBAUT, Directeur de recherche CNRS émérite, LMGC, Montpellier
Directrice de thèse | Mme. Iris BRÉMAUD, Chargée de recherche CNRS, LMGC, Montpellier
Co-encadrant de thèse | M. Patrick LANGBOUR, Chercheur CIRAD, BioWooEB, Montpellier
Invité | M. Arnould OLIVIER, Maître de conférences, LMGC, Montpellier