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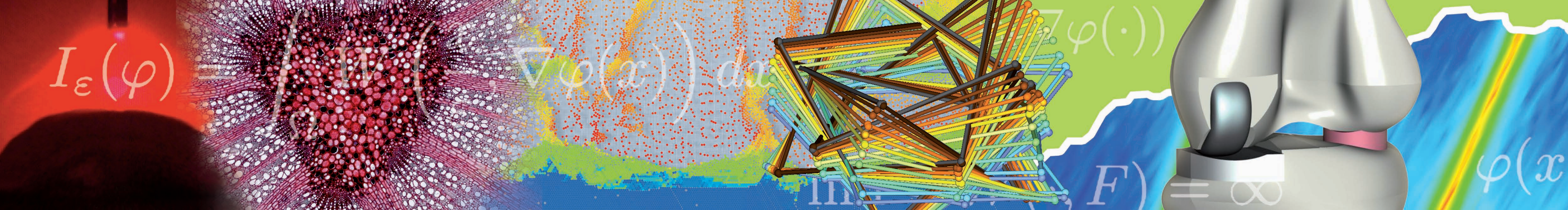
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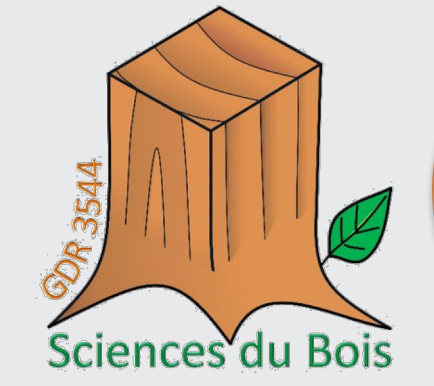
# Beyond « Clear Wood »: Exploring the Structure-Properties of Figured Woods and of Woods with Strong Gradients Selected in Craftsmanship

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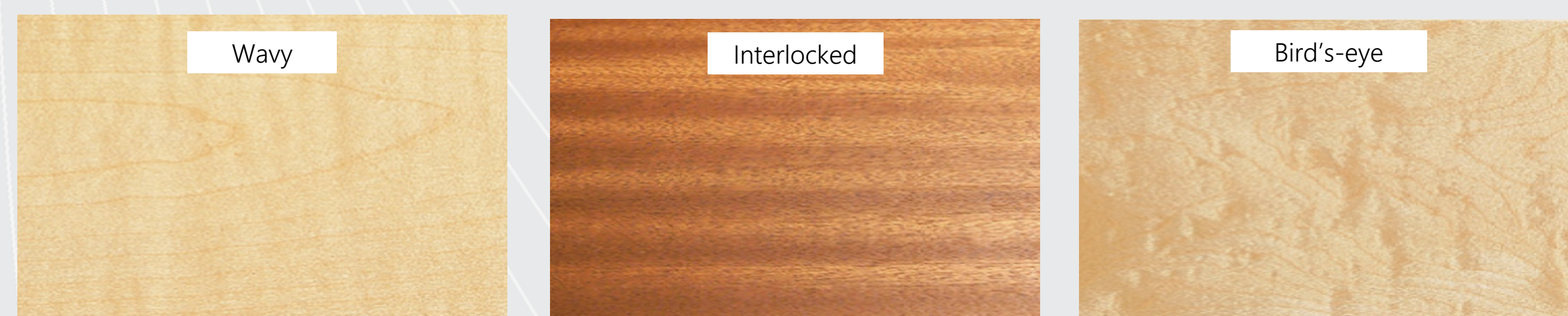
## CONTEXT

This poster is to present a beginning Ph.D. research for the study of wood with artisanal usage with non-straight or heterogeneous.

A paradox between the viewpoints of engineering sciences and of the artisanal usage for wood is posed:

- In natural, homogeneous wood is singularity
- From engineering viewpoint, a good quality wood is orthotropic (clear wood), with homogeneous character.
- To the artisanal usage, heterogeneity and/or singularity could be seemed as defect or quality.

The goal for this program is to fulfil the gap of knowledge of heterogeneous woods (e.g. figured wood and grain deviation).



<http://en.woodtec.co.jp/products/individuality-tree/>

## WORK PROJECTS

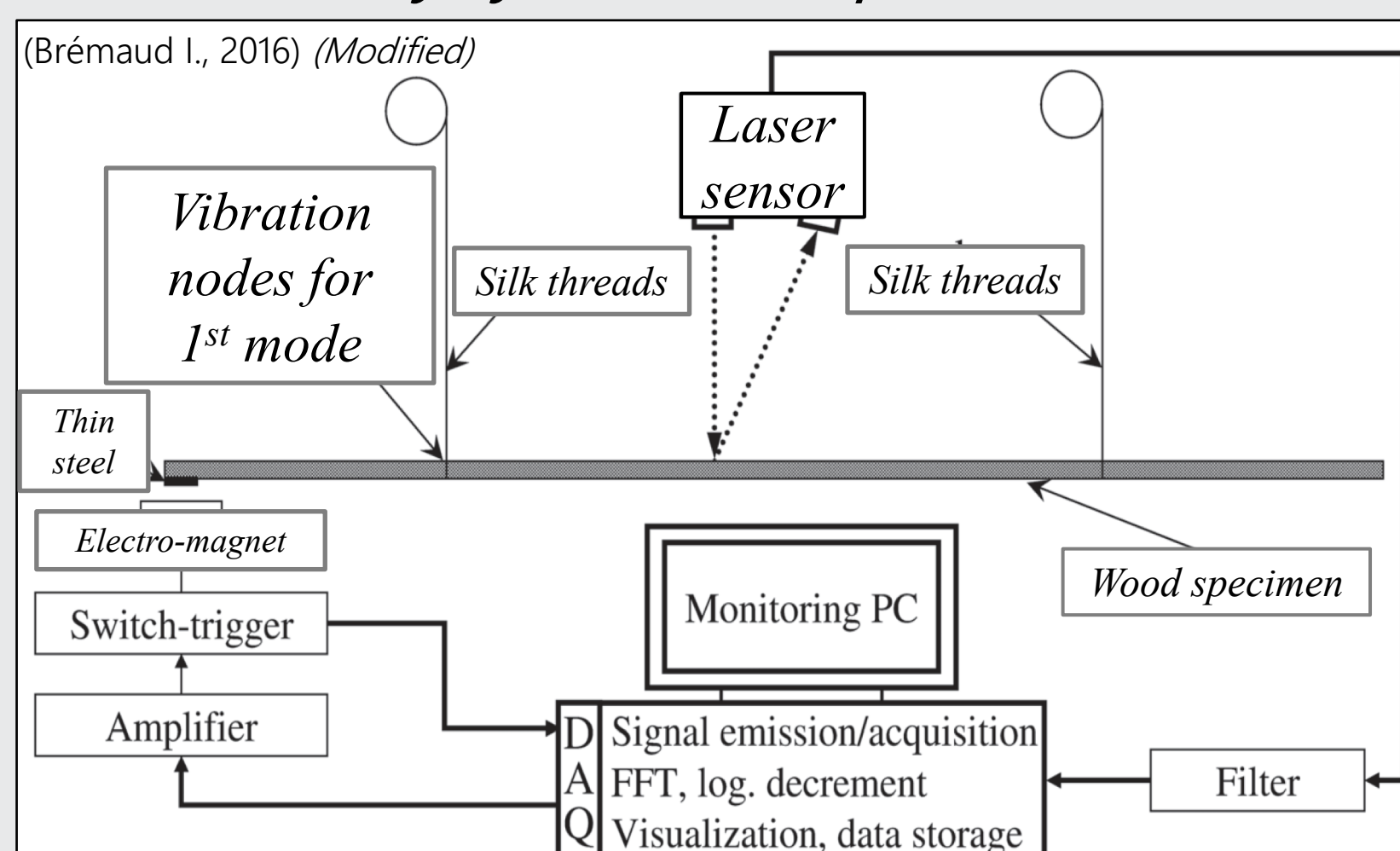
- Surveys with craftsmen for the uses of wood with high gradients of properties and the selection trade-offs.
- Establishment of a typology of wood according to different patterns and usages.
- Exploration of botanical diversity and variability to determine the certain singularities and mechanical characteristics.
- Reducing the problem according to the typology of the observation scales relevant for the multi-scale analysis. Experimental characterization (and modelling) of the structural mechanical repercussions in conditions with high gradients of properties.
- Study of the visio-tactile sensory perception by craftsmen, especially for figured woods.

## References

- Alkadri, A., C. Carlier, I. Wahyudi, J. Gril, P. Langbour and I. Brémaud (2018). "Relationships between anatomical and vibrational properties of wavy sycamore maple." IAWA Journal 39(1): 63-86
- Brémaud, I. (2016). Vers une vision « ethno-bio-mécanique » des bois - La rhéologie du matériau-bois à l'interface entre diversité botanique et usages en lutherie et artisanats. HDR Univ. Montpellier. 149pp
- Cabrolhier, P., Description et comportement mécanique des bois contrefilés, 2007, Université Montpellier 2 (Sciences et Techniques)

## EXPLORATION

- "Figured wood" appeared in journal of timber industries, veneer, furniture making, commercial brochures, etc., ...
- 1910 BORTHWICK AW: The production of adventitious roots and their relation to bird's-eye formation (Maserholz) in the wood of various trees.
- 1933 HOLMBERG LH: Is suppression a possible cause of bird's-eye in sugar maple? PILLOW MY: Detection of figured wood in standing trees.
- 1952 BAUMER M: A propos des figures du bois.
- 1969 CHAFE SC: Dimpled grain in wood. CARLQUIST S: Wood anatomy of Lobelioideae (Campanulaceae).
- 1977 BEALS HO & DAVIS TC: Figure in wood: An illustrated review.
- 1979 HEJNOWICZ Z: The common basis of wood grain figures is the systematically changing orientation of cambial fusiform cells. Anatomy observation, genetic relationship, appearance of figured for CAD are focused on...
- 2007 Cabrolhier P: Description et comportement mécanique des bois contrefilés
- 2018 Alkadri A et al: Relationships between anatomical and vibrational properties of wavy sycamore maple



Measuring instrument system (Vybris) for the dynamic modulus properties, developed in LMGC for a decade's researches of the anisotropic characteristics for the wood with strong gradients (interlocked grain, wavy grain, curly grain...)

## FUTURE WORK

Multi-scale Analysis & FEM

Measurement of MFA Micro-scope scale (Alkadri et al., 2018)

Use the parameters from micro-scope and meso-scope scale transformed to the global behavior (Cabrolhier P., 2006)

Meso-scope scale of the type of wood with grain deviation (Alkadri et al., 2018)

Mechanical properties of micro-specimens; comparing it with the multi-scale prediction and the further step: macro-scope behavior

Using optical and image analysis for the measurement for figured woods

Calculating the ratio of figured tissue and non-figured tissue Correlation for micro-, meso- and macro-scope

