294th Regular Open Seminar（2023/2/8）

Title：Some research on mechanics of tree and wood

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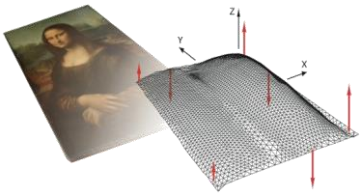
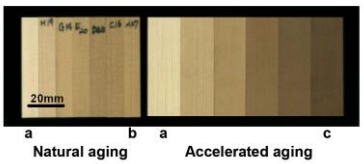
Related RISH mission： -Mission 4 (Development and Utilization of Wood-based Sustainable Materials in Harmony with the Human Living Environment)
- Mission 5（Quality of the Future Humanosphere）

Abstract：
Wood as an object of research can be considered as a component of trees, a material used by humans, or an archive of the past. The presentation will focus on subjects involving wood mechanics but also interactions with other disciplines. (1) Wood shaping, such as bending of bars or fixation of transverse compression, illustrate the hygro-thermo-mechanical couplings in wood. Comparing microstructure of wood densified in different conditions proved the use of coal-like material by our ancestors, in an experimental archaeological approach. (2) The follow-up of Mona Lisa, started in 2004 for the Louvre Museum in Paris, initiated research on hygro-mechanical modelling of painted panels and conservation of historical wooden objects in general. (3) Wood from repairs of Buddhist buildings was used to study the effect of natural ageing on wood properties, and similar modifications attempted through mild thermal treatments. Observations of remains from the burnt roof of Notre-Dame-de-Paris cathedral will allow going one step further by observing the combined effect of age and heat. (4) The unexplained breaking of tree branches in Summer hinders the promotion of tree planting in cities to improve thermal comfort in the face of global warming. The approach adopted to address the issue of their mechanical strength is based on biomechanical modelling similar to that of inclined trunks.



Finite element modelling of Mona Lisa wooden support (designed by O. Arnould)



Equivalence between darkening of old and heat-treated wood: (a) control; (b) 1580 year-old wood; (c) wood treated 120h at 180°C. (Matsuo et al., Holzforschung, 65, 361, 2011)

Summer limb drop Nîmes June 2018 (photo C. Mollaret)