

Colloquium No 556 Scientific Report

Wood is one of the oldest materials used by mankind. Nowadays, it is of significance for a huge variety of applications starting from large span glued laminated timber beams and load carrying components in Civil Engineering, up to for example music instruments as well as pressure, heat and moisture modified material for new, innovative products. Apart from the mechanical and aesthetical quality of the material, its eco-friendly features are of high significance. Thus, it can be assumed that the importance will even grow in the future.

In order to provide the desired, optimized components and to develop new applications, deep mechanical knowledge, theoretical modelling, experimental investigations and numerical simulation approaches are required. Features to be identified are amongst others anisotropic elasticity, ductile plasticity, brittle fracture and time-, moisture- and temperature-dependency. Moreover, the material shows very pronounced properties on different length scales so that it even could be described as a composite structure itself instead as a homogeneous material. The features depend on a large number of influence factors like growth conditions and yield a significant amount of scattering with respect to its properties. Due to this complexity and manifold dependencies, a lot of research is required in order to be able to understand and to describe wood properly from the mechanical point of view. Currently, lively and advanced research activities are under way in order to develop a comprehensive knowledge.

This Colloquium aimed to bring wood-mechanical scientists together for the presentation of their research and to deliver a platform for fruitful discussions. There were altogether about **50** participants and 39 presentations, among them three key-note lectures, namely Erik Serrano (Lund University, Sweden), Ingo Burgert (ETH Zurich, Switzerland) and Hans Joachim Blaß (KIT Karlsruhe, Germany); see also the list of participants and the full programme. As an important component of the colloquium, there were a lot of opportunities for common discussions and informal dialogues between the participants.

To deliver a forum for this wide spectrum and as a consequence of the wide-ranging field of analyses in wood mechanics a large number of different issues was presented and discussed which can be categorized into the two main topics:

- **Experimental Analysis:**

In different sessions, a plenty of knowledge could be shared concerning specific material properties of partially exotic wood species and timber which are important for an appropriate analysis of them. Timber and wooden products are commonly used in architecture and industry. Thus, there is a need of knowing the mechanical behaviour. The participants got an insight in, e.g. the behaviour of moulded wooden beech tubes, or the influence of climate, e.g. on an antique violin during a concert. Further, the mechanical behaviour of joints, e.g. dowel connections, was regarded. Measurement techniques for damage detection in wood and wooden structures were discussed in other sessions. Opportunities for, e.g. optical measurement of strains in living trees under bending, or the monitoring of deformations of the famous panel painting “Mona Lisa” were pointed out.

- **Theoretical and Numerical Analysis:**

The theoretical and numerical analysis of wood and wooden or timber structures is highly dependent on the results of experimental analysis. For all developed and applied theories and material models the verification with experiments is essen-

www.euomech.org

PRESIDENT

GertJan van Heijst
G.J.F.v.Heijst@tue.nl

VICE PRESIDENT

Patrick Huerre
huerre@ladhyx.polytechnique.fr

SECRETARY GENERAL

Pierre Suquet
Laboratoire de Mécanique et
d'Acoustique
31 chemin Joseph Aiguier
13402 Marseille Cedex 20
suquet@lma.cnrs-mrs.fr

TREASURER

Wolfgang Schröder
office@aia.rwth-aachen.de

tial. In recent research projects, discussed at the colloquium, wood failure mechanisms are regarded intensively. Therefore, one session dealt with the simulation of fracture. Different theories and models, like e.g. XFEM, were introduced. A great challenge remains the simulation of timber structures. Due to the high variability of all properties of this natural material and manifold inhomogeneities, like knots etc. there is a large uncertainty in the behaviour of timber. A model for the determination of knot orientation and element formulations in the scope of the FEM, as well as possibilities to regard uncertain parameter by randomness or fuzziness were presented. Another aspect was the theoretical and numerical modelling of wooden products, like e.g. wood shear walls, furniture or cross laminated timber. In any case, the hygro-mechanical coupling was pointed out as a predominant influence on the performance of wood. Theoretical models and investigations for the origin of swelling and shrinkage gave an insight into the microstructure of wood, while different models for simulating moisture transport and its effect on the mechanical behaviour of wooden structures were lively discussed. The practical relevance of numerical analyses on the macro-scale was underlined by case studies on panel paintings and a violin.

Recent advances in understanding the physical properties of wood, the mechanical behaviour of wood based products but also in simulating related problems were collected at the EUROMECH Colloquium 556 on Theoretical, Numerical, and Experimental Analyses in Wood held in Dresden, Germany, from May 27th to 29th 2015. This international symposium provided a dedicated forum for wood mechanics and offered a great opportunity for the presentation and the discussion of several current issues. The resonance of the participants on this colloquium was unexceptionally positive. They appreciated to join this scientific forum and could benefit from the friendly and concentrated atmosphere within the EUROMECH Colloquium in the picturesque city of Dresden. At the moment, another Colloquium on the same or a related subject is not planned. Nevertheless, further effort needs to be applied in all scopes of analyses in wood mechanics. Getting into contact with other scientists in this special but versatile field, this platform was another step to further research, new scientific and technical approaches as well as the scientific exchange between wood scientists and their collaboration in order to lead to better understanding of this fascinating material and its products.

Finally we wish to acknowledge the EUROMECH for making this fruitful scientific colloquium possible, and for the financial and organisational support.

Dresden, 29 June 2015

www.euomech.org

PRESIDENT
GertJan van Heijst
G.J.F.v.Heijst@tue.nl

VICE PRESIDENT
Patrick Huerre
huerre@ladhyx.polytechnique.fr

SECRETARY GENERAL
Pierre Suquet
Laboratoire de Mécanique et
d'Acoustique
31 chemin Joseph Aiguier
13402 Marseille Cedex 20
suquet@lma.cnrs-mrs.fr

TREASURER
Wolfgang Schröder
office@aia.rwth-aachen.de

