

Hygromechanical behaviour of a wooden panel

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Wooden panel paintings from cultural heritage are excellent case of study for an engineer. They are witness of ancient times and practices, and may provide keys to the understanding of long term behaviour of wooden structures [1,2]. A particularity of these objects is the permanent cupping of the panel. It seems to appear whatever the orientation of the panel cutting (quartersawn or flatsawn) and the position of the paint layer. One of the possible origins of this cupping is the compression-set [3], due to a combination of mechano-sorptive and plastic behaviour of wood. This phenomenon is more severe when the panel is restrained, so that shrinkage and swelling are prevented and stresses generated during cycling changes of humidity lead to the cracking of the wooden support. For our study, we try to reproduce a panel mock-up, taking care to characterize each component at each step until the final result: a permanently cupped panel. We will introduce the first step, where the sorptional and mechanical behaviour of an uncoated panel is monitored using image correlation techniques and continuous weighting. The following step concerns a panel coated onto its 4 lateral faces. The last step will consider the behaviour of a panel coated on 4 lateral faces and one principal face.

Numerical simulations will be presented to explain the theoretical behaviour of a wooden panel submitted to these hygro-thermal loadings.

References:

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- [2] Marcon, B., *Hygromécanique des panneaux en bois et conservation du patrimoine culturel*. PhD thesis, Montpellier 2 University, Università degli studi di Firenze, 2009 (in French).
- [3] Uzielli, L., Historical Overview of Panel-Making Techniques in Central Italy - In: Proceedings of the 1995 Symposium on "The structural conservation of panel paintings", K. Dardes and A. Rothe Editors, The Getty Conservation Institute, Los Angeles, 110-135, ISBN 0-89236-384-3, 1998