Characterization of cracked wood under thermo-hydro-mechanical and viscoelastic behavior

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CONTEXTE & OBJECTIFS

❖ **Use of wood-based materials in sustainable constructions aims to reduce the environmental impact of buildings.**
❖ **Improve the competitiveness of timber structures.**
❖ **Study the fracture of wood due to environmental loadings**

❑ **Scientific Problem**

❖ **Integration of the temperature and moisture changes in invariant integrals**
- Standard form : Integral T
- Implementation in the FEM : integral A

❖ **Coupling with an orthotropic viscoelastic behavior**
- Rewrite the energy balance
- Generalization for the crack growth process

❖ **How takes into account mixed mode configurations**
- Integration in the Integral A
- Implementation in the crack growth process algorithm

MATERIALS AND METHODS

❑ Invariant Integral A

$$A = T_\theta = \int_V -\frac{1}{2}\left[\sigma_{ij,1}^v u_i - \sigma_{ij}^u v_{i,1} - \gamma\Delta T(v_{1,j} - \psi_{1,j}) + \gamma\Delta T_{,j}(v_1 - \psi_1)\right]\theta_{1,j}\,dV$$

A_1: Standard form = Mθ integral A_2 : Temperature effects

$$-\int_{A_1A_2+B_2B_1} T_i\,v_{i,j}\,\theta_j\,dx_1$$

$$-\int_V \left[\sigma_{ij,k}^v u_{i,j} + \sigma_{ij,k}^u v_{i,j} + \beta\delta_{ij}u_{i,jk}\Delta T\right]\theta_k\,dV$$

A_3 : Pressure crack tip expansion during the crack growth A_4 : Pressure and shear effect on crack lips

❑ MMCG Geometry

❑ Kelvin Voigt model

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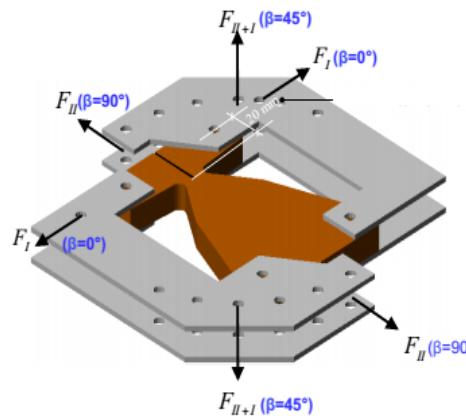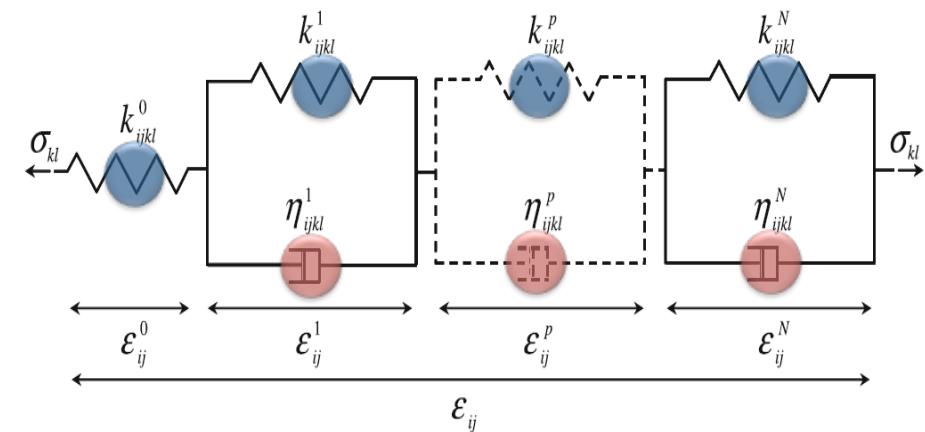
Numerical results

❑ **Influence of a Temperature Gradient**
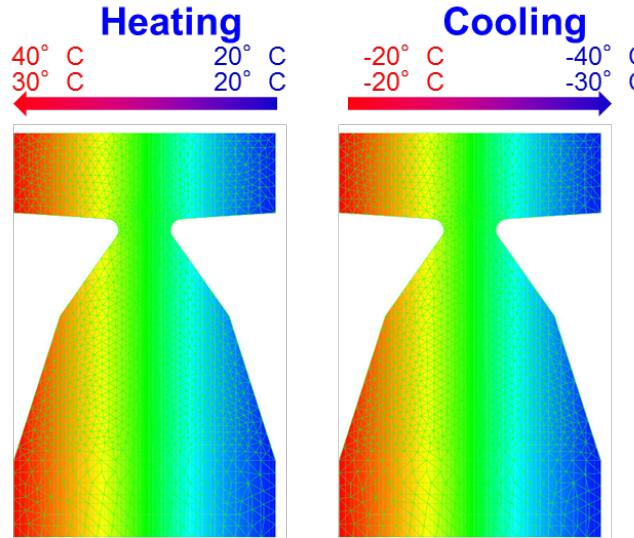
❑ **Homogeneous Moisture Content Variation in mixed mode**
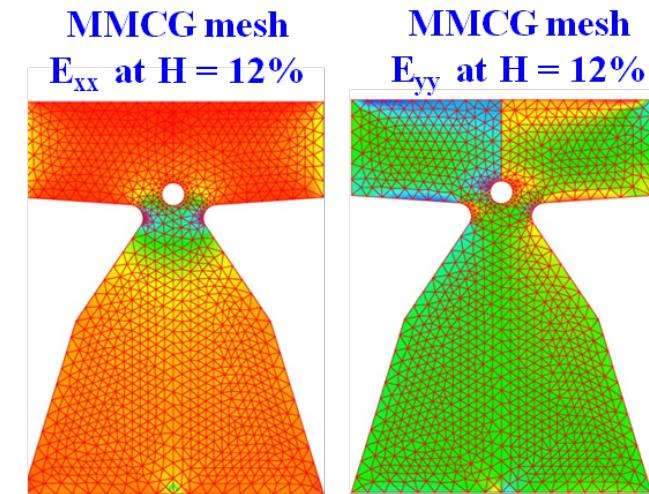
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