

Investigation of Douglas fir and white fir beams deflections subjected to climatic changes

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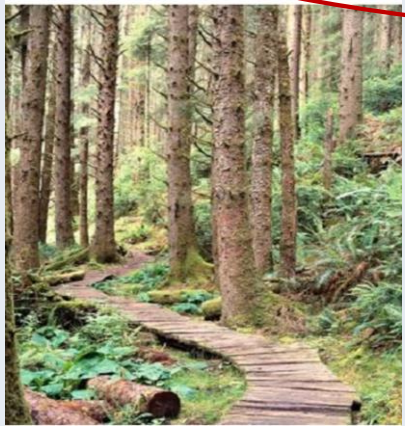
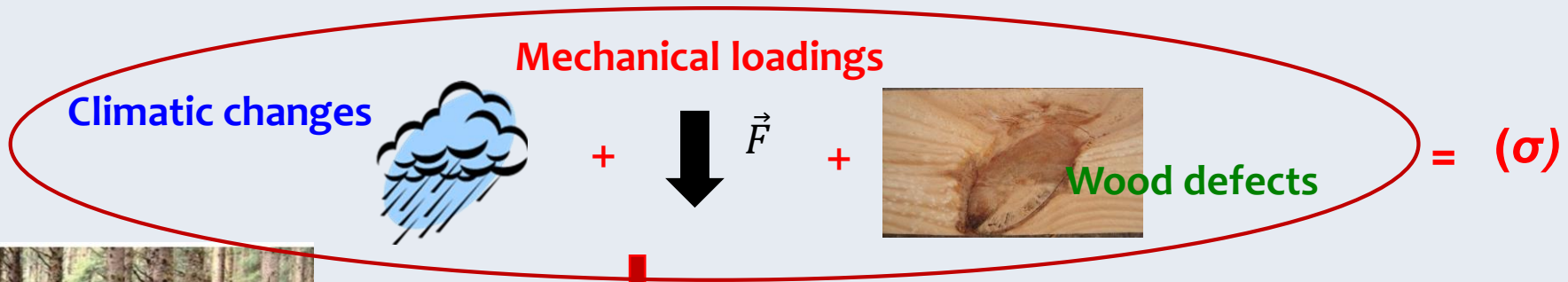
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Scientific context

- ❑ National and Regional interest of White Fir (WF) and Douglas fir species
- ❑ Valorization of European wood
- ❑ Relationship between crack propagations, wood defects, climatic changes and mechanical loadings in life's structure of wood



What are the impacts of (σ) on the life's of these species



Material and method

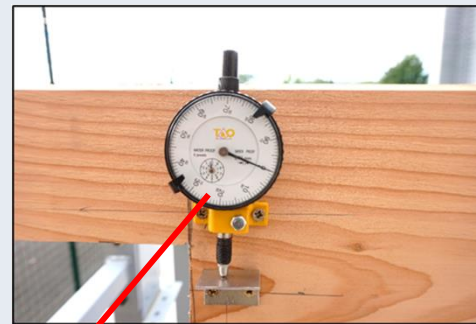
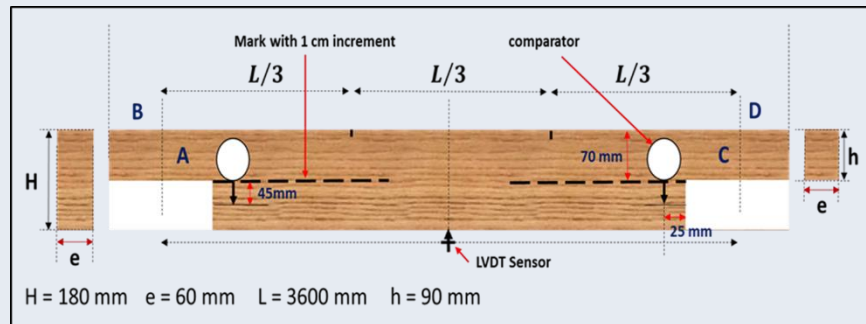


Figure 1: Type of notched beam

Figure 2: Comparator

Figure 3: LVDT sensor



Figure 4: (a) beams of Douglas fir in creep test; (b) beams of white fir in creep test

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1. Context & Objectives

$\text{Climatic changes} + \text{Mechanical solicitations} + \text{Wood defects} = (\Delta)$

What is the impact of (Δ) on the life's structure of wood?

- Proposed an experimental model of creep loading in climatic changes
- Investigate the impacts of RH and T on the evolution of deflection
- Investigate the impacts of crack propagation on the evolution of deflection
- Study the effects of the coupling of climatic parameters, crack propagation and the loading intensity on the evolution of deflection

2. Experimental Setup

Type of specimen use: $11.18 \text{ m} \pm 0.02 \text{ m}$, $1 \times 300 \text{ mm}$, $1 \times 100 \text{ mm}$

Beams in external creep loading | LVDT sensor

3. Results

3.1. Influence of RH and T on the evolution of deflection

Figure 1 shows that the deflection increases during the moistening process (Fig. 1a and 1c) and during the drying process (Fig. 1b and 1c) the curve seems to return to its initial position

Figure 1: Typical evolutions of the beams deflections vs climatic changes

3.2. Influence of RH and T on the evolution of the crack

Figure 2: Typical evolutions of tips crack length and crack opening vs climatic parameters

Figure 3 presents the typical propagations of tips of the cracks (Fig. 3a) appeared at the notched of beam and the propagation of the crack opening (Fig. 3b) versus the evolution of temperature of the middle. As presented, the results show that the growth of the cracks length are carried out during the drying process. Indeed, the ellipses showing in the Fig. 2 show that the evolutions of these two parameters are effective during the rise phase of temperature

3.3. Influence of crack propagations on the evolution of deflection

Figure 3: Typical evolutions of the beams deflections vs crack propagations

4. Perspectives

Propose an analytical model of beams deflections versus RH and T taking into account the crack propagations phenomenon and the diffusion phenomenon in wood

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