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Research interests:

Finite element modelling of wood especially modelling of local wood properties, modelling of wood machining, wood drying, wood mechanics etc.

Modelling Thermoelasticity and Hygroelasticity for Orthotropic Materials

Linear elastic stress-strain relations in incremental form (1D)

$$d\varepsilon = \frac{d\sigma}{E} + \alpha\, dT$$

”Original” Hookes law

$$d\varepsilon = \frac{d\sigma}{E} + \alpha_0 dT - \frac{\sigma}{E^2}\left(\frac{\partial E}{\partial T} dT\right)$$

Thermoelasticity (Rosenfield, Averbach, 1956, for metals)

$$d\varepsilon = \frac{d\sigma}{E} + \alpha_0 dT + \beta_0 du - \frac{\sigma}{E^2}\left(\frac{\partial E}{\partial T} dT + \frac{\partial E}{\partial u} du\right)$$

Thermoelasticity and hygroelasticity as presented here

Why are the extra terms in the elastic stress-strain relations important?

- Because the usual approach is to divide the total observed strain in two main parts, linear elastic strain and nonelastic strain
- The nonelastic strain is after that divided into different kinds of strain, e.g. plastic strain, mechano-sorptive strain and creep strain.
- Mechano-sorptive strain is nonlinear and due to stress and at the same time temperature and MC changes.
- The extra terms in the elastic stress-strain relations shown here are also significant when there is stress and at the same time temperature and MC changes.

- Conclusions: mechano-sorptive strain may be unintentionally mixed up with linear elastic strain if the extra terms are left out. Comparions of the size of the extra terms defined here and mechano-sorptive constants from literature show that this might be the case.