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CT-studies during the Conditioning phase of the Wood Drying Process

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Computed tomography (CT) during drying of sawn timber is an excellent non-destructive technique to study the moisture flux as a function of drying time. In this study, a climate chamber combined with a medical CT- scanner has been used for non-destructive studies of density changes in sawn timber during drying and conditioning.
Green sawn timber contains large amounts of water and has to be dried before it can be further processed and used in various building applications. The most common drying method is convective air-circulation drying in large industrial kilns, where the relative humidity (RH) of the hot circulating air is gradually reduced until the timber reaches the target moisture content (MC).
Drying of sawn timber is driven by the existence of a difference in MC between the core and the surface, so that moisture moves from the wet inner region towards the drier outer region. During the early capillary stages of drying, the drying rate is high while, at the later stages when all liquid water has evaporated, the drying rate is slow and diffusion-controlled. At the end of the drying process, the timber surface is always drier than its core. In addition to this moisture gradient, internal stresses develop within the cross section with compression stresses in the timber surface and tension in the inner regions. To avoid unwanted distortions, both these stresses and the moisture gradient, need to be eliminated before the timber is further processed. This is achieved in a final conditioning stage within the drying process by moistening the circulating air through steaming or water spraying.
The aim of the present work was to optimize the conditioning stage by developing a method for studying of moisture gradients, deformations and internal and external dimensional changes in sawn timber during the conditioning phase by using a CT-scanner combined with a drying unit for in-situ measurements of moisture flow.
The results show that it is possible to detect the moisture gradient between the surface and core of the timber with satisfactory reliability, but not the internal and external dimensional changes. However, this method creates a potential for increasing the knowledge and understanding of the conditioning phase and makes it possible to optimize and develop this step in the drying process to improve the yield and ensure a higher quality of the sawn timber.