Finite element analysis of coupled nonlinear heat and moisture transfer in wood

A nonlinear model for analysing heat and moisture flow in wood during drying below the fiber saturation point is presented. The model used considers wood at a macro level without taking the various moisture transports mechanisms at the microscopic level into account. Based on the finite-element method, a coupled system of equations resulting from the adopted heat and moisture transfer equations is established and an iterative scheme is proposed. The numerical procedure is verified by a test example. In a two-dimensional analysis, the influence of the coupling on the combined heat and moisture transfer is studied for a board subjected to a typical kiln-drying condition. How well the results agree with those obtained by introducing a commonly applied simplification is discussed.