Strain distributions around knots in *Picea abies (L.)* boards subjected to tensile load.

C. Buksnowitz [1], U. Müller [2], W. Gindl [1], J. Konnerth [1]

[1] Institute of Wood Science and Technology, Department of Material Science and Process Engineering, BOKU - University of Natural Resources and Applied Life Sciences, Vienna
[2] Wood K Plus, Kompetenzzentrum Holz GmbH, Competence Center for Wood Composites and Wood Chemistry, Linz

Department of Material Science and Process Engineering

University of Natural Resources and Applied Life Sciences - Vienna
Institute of Wood Science and Technology

Introduction: Knots are the most abundant discontinuities in timber with a high variability and major effects on mechanical as well as aesthetical properties of sawn wood. The mechanics of trees [1], the junction between branches [2] and the trunk have been subject to very few studies compared to the importance.

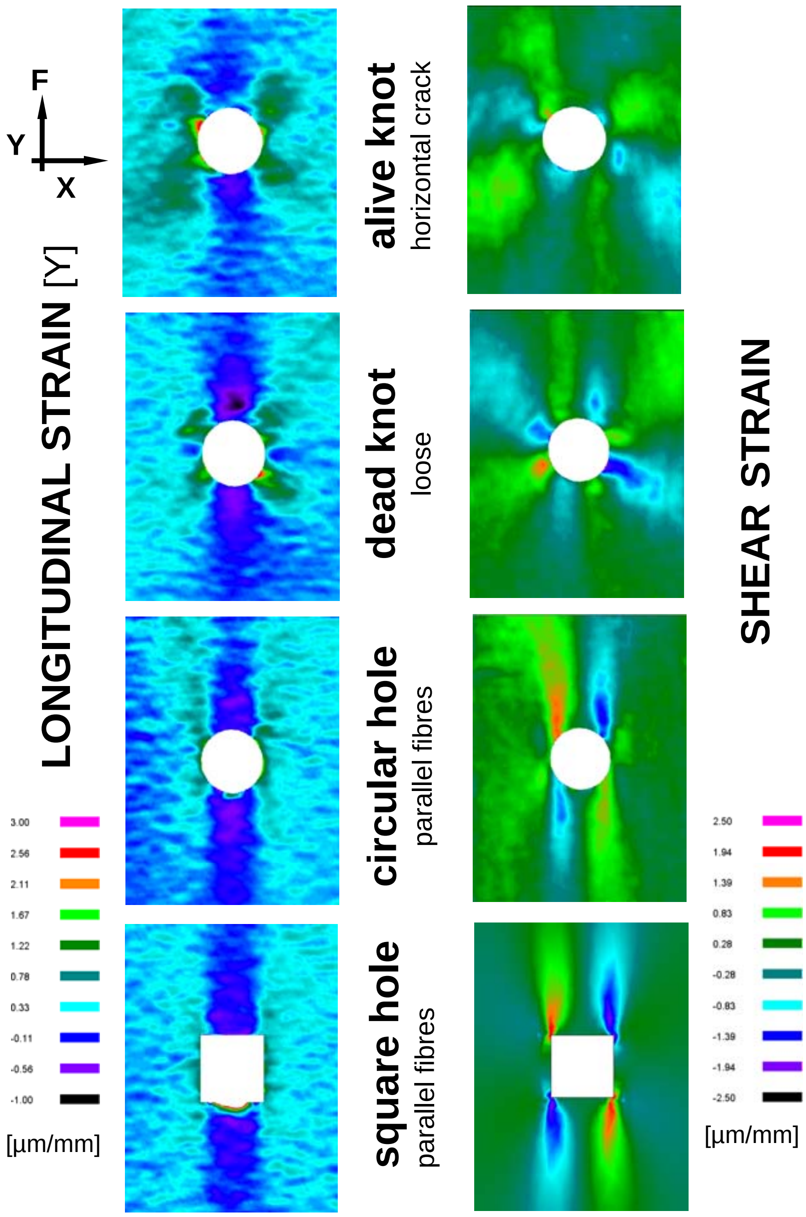

Figure 2: Distribution of longitudinal strain and shear strain of Spruce wood specimens with an alive knot, a dead knot, a circular hole drilled into a board with parallel fibre orientation and a square hole in a clear wood sample with parallel fibres.

Material and Methods

Boards of Norway spruce *Picea abies (L.)* (Fig. 1) were subjected to tensile load in the linear elastic range (up to 10 N/mm²) in the longitudinal direction.

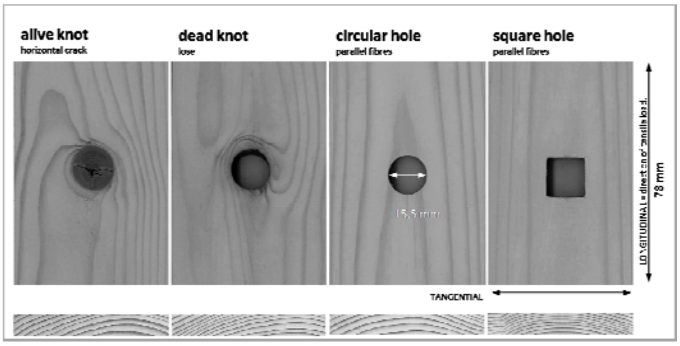

Figure 1: Spruce wood specimens as used for strain measurements.

The distribution of the longitudinal strain and the shear strain was determined by means of electronic laser speckle pattern interferometry (ESPI).

Results and Conclusion

Figure 2 illustrates the observed longitudinal strain and shear strain distributions. Around an alive knot the strain showed the lowest gradients. The dead knot displays an intermediate state whereas distinct strain concentrations (mainly shear strain) can be found in the case of the holes in clear wood with parallel fibres.
At the basis of the present knowledge it is assumed that the optimised transfer of mechanical loads (homogenous strain) around knots can be ascribed to both naturally optimised fibre course and cell-morphology in the junction area.

References:
[1] C. Mattheck, Why they grow, how they grow – the mechanics of trees. Aboricultural Journal, **14**, 1-17. (1990a)
[2] U. Müller, W. Gindl, G. Jeronimidis, Biomechanics of a branch - stem junction in softwood. Trees –structure and function, in press, (2006)