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Torsional Fatigue Properties of Wood

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Abstract: The torsional fatigue properties of two woods (Japanese beech and white cedar) under controlled torque were investigated experimentally. Pulsating torsional loading was applied about the longitudinal direction of wood. The pattern of repetitive loading was the reversed cyclic sine-waveform loading and the applied frequencies were 0.1 Hz and 1 Hz. The following results were obtained. 1) A negative correlation was observed between the shear stress level and the logarithm of the number of cycles to failure (N_f). 2) The N_f at the frequency of 1 Hz was larger than that at 0.1 Hz. 3) The average energy loss per unit cycle was inclined to converge to a certain value with increasing N_f . This value was considered to be equal to a quantity which was not related to the initiation and propagation of micro-fractures in the specimen. We estimated the converged values at 0.7 kJ/m³ for Japanese beech and 0.5 kJ/m³ for white cedar. From these results, the torsional fatigue limits of both species were assumed to be about 30% of stress levels.

Keywords: torsional fatigue, energy loss, frequency, *S-N* curve, shear stress



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