

INVESTIGATION ON ASYMMETRIC HYSTERESIS FRICTION BEHAVIOR BETWEEN HARDWOOD AND A SPHERICAL STEEL PIN

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KEYWORDS

Biotribology; Experiments in tribology; Friction; Wood material

ABSTRACT

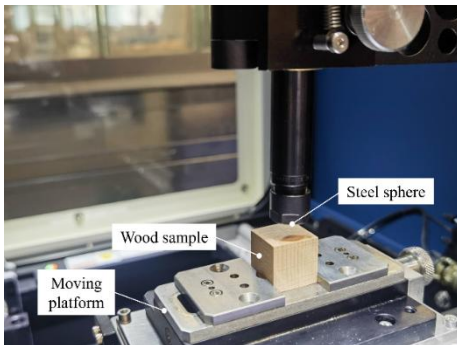


Fig.1 Reciprocating friction test between hardwood and spherical steel pin.

The friction properties of wood are influenced by many factors, among which the moisture content of wood [1] and the fiber direction on the contact interface [2] deserve special attention. This research focusses on the friction behavior, observed during a reciprocating sliding motion, between hardwood and a spherical steel pin. European beech and spruce have been cut into specific sizes to make wood samples, and a reciprocating sliding tribometer is used to measure the friction between the wood samples and a steel sphere. The experimental setup can be seen in Fig. 1. The reciprocating friction test was conducted under a fixed normal force equals to 30N and sliding frequency equals to 1Hz, the sliding distance was 5.92mm. We found that there are obvious hysteresis phenomena in the slip phase when the radial plane of beech wood samples is tested and the sliding direction is perpendicular to the direction of wood fibers, as shown in Fig. 2.

Theoretical studies were then conducted to explain the asymmetric hysteresis behavior in the reciprocating friction test. Since the stiffness of wood samples varies over the growth rings of wood samples, the corresponding indentation depth over the sliding distance will also change. This will cause a deviation between the direction of the real friction force in the

interface and that of the measured horizontal friction force, which causes the fluctuation in the measured force [3]. An identification procedure was developed and applied to quantify the actual coefficient of friction in the interface. Furthermore, a framework to identify the varying contact stiffness over the growth ring of wood is also proposed. The latter framework assumes the distribution of the wood contact stiffness to be discretized by local polynomials. By estimating the coefficients of those polynomials, it is possible to quantify the distribution of the contact stiffness over the sliding area.

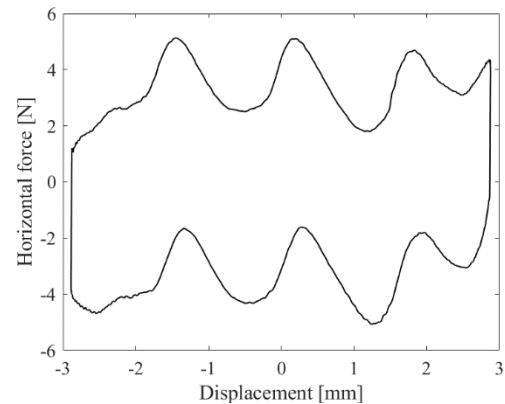


Fig.2 Frictional hysteresis loops: normal force equals to 30N, reciprocating frequency equals to 1Hz

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