Crack Initiation Mechanism and Crack Analysis of Walnut

In order to achieve the complete separation of walnut shell and kernel, this paper aims to study the mechanical properties and cracking state of the shell surface of the Qingxiang walnut under unidirectional load. The goodness of fit (within 5%) of the spherical thin shell model was verified by the texture meter shell breaking experiment; A gradient decreasing distribution of shell stresses within the domain of load concentration forces was found by moment free theory and finite element simulation, and the internal forces are equal in all directions away from this domain; The fracture law of the shell surface along the grain was found by strength theory and solid fracture mechanics analysis; Finally, a walnut shell grasped by three-finger dexterous hand breaking experiment was designed to verify that the theoretical model in this paper is consistent with the actual walnut shell breaking state under unidirectional load, and the walnut cracks in the experiment are obvious, which is conducive to shell-kernel separation. The research results can provide a theoretical basis for the research and development of shell breaking machinery, and provide reference for the structural design and optimization of key components.

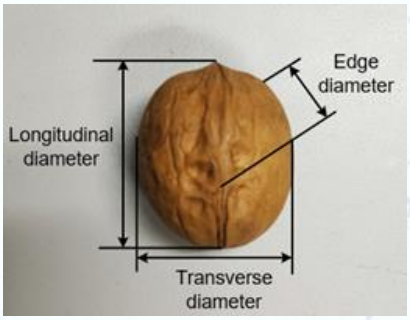

Fig.1. Schematic diagram of walnut diameter

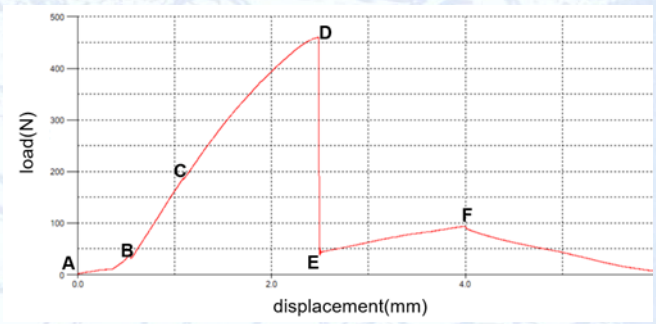

Fig.7 Y Under load walnut breaking shell force – displacement curve

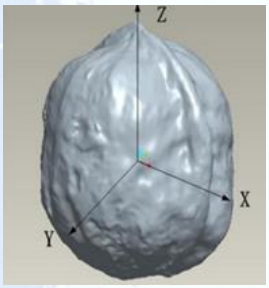

Fig.10 Walnut 3D Scan Model

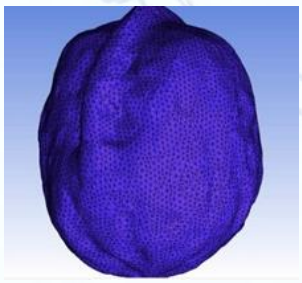

Fig.11 Meshing

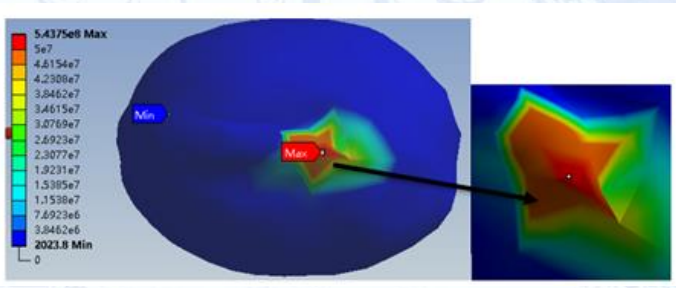

Fig.12 Stress cloud map

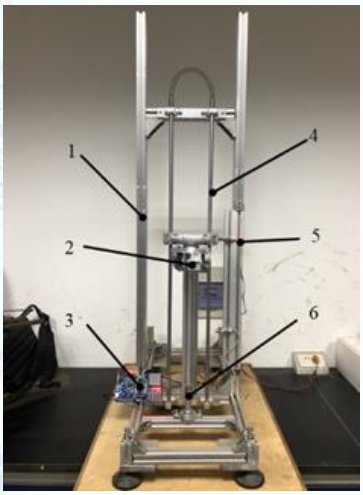

Fig.13 Mechanical claw shell test bench. (1) frame; (2) three fingers mechanical claws; (3) microcontroller; (4) slider rail; (5) close switch; (6) impact table.

Fig.14 Walnut crack and the complete kernel

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