

A Numerical study of the impact resistance of woodpecker's head

YuZhe LIU¹, *XinMing QIU¹, Xiong ZHANG¹, T.X. YU^{2,3}

¹ Department of Engineering Mechanics, Tsinghua University, Beijing 100084, China

² Department of Mechanical Engineering, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong

³ Y.K. Pao Chair Professor, Ningbo University, Ningbo, China

* Corresponding author: 8610- 62772329, e-mail: qxm@tsinghua.edu.cn

Woodpecker strikes trunk every day and is able to resist brain impact injury at high deceleration, which is estimated to be as high as 1000g. In this study, the endoskeletal structures that protect woodpecker's brain are investigated, especially its long and stiff hyoid bone, which is quite different to other birds. The material point method (MPM) is employed to reconstruct a three-dimensional simulation model of a woodpecker's head, based on the micro-CT scanning images. In order to determine the damage of the impact in brain, the brain injury criteria of the shear stress in the midbrain of the brainstem (SSS) is adopted. The result indicates that the existing of hyoid bone approximately reduces the SSS by half.

Keywords: Woodpecker, MPM, Impact resistance, Brain injury, SSS