Non-Destructive Approaches for Evaluating Young's Modulus in Human Bones Using Impulse Excitation

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The aging global population has triggered a concerning surge in age-related health issues, notably osteoporosis and hip fractures, posing significant challenges to healthcare systems. This research endeavors a novel approach and to validate methodologies for assessing the mechanical properties of human bones using non-destructive techniques, with a particular focus on determining dynamic Young's modulus through various approaches guided by the Impulse Excitation method (ASTM E 1876 - 01). Considering the challenges encountered, the quest for non-destructive methods to accurately evaluate bone properties assumes paramount importance. Initial experimentation with methodologies like Arduino and Python spectrum techniques encountered difficulties, prompting a methodological shift towards the Audacity method. Despite initial challenges, the Audacity method yielded consistent results, offering valuable insights into bone mechanical properties. Anticipated outcomes encompass comprehensive characterization of fracture propagation mechanisms and the development of predictive numerical models. This study asserts that a validated methodology, exemplified by the Audacity method, establishes a robust groundwork for ongoing investigations into fracture mechanics, with far-reaching implications for healthcare strategies and fracture prevention.

Keywords: *Human Bones, Dynamic Young's Modulus; Fundamental Resonance Frequency; Impulse Excitation Method; Audacity Method*