Group #25

AXIAL SPINE TESTING

Team Members: Abigail Smith, Tsubasa Kitada, Parker Abramson, Rina Matsuo
Mentor: Zac Dooley / OrthoFix Medical Inc.
Co-Mentors: Dr. Alyssa Taylor

Abstract

Current spinal implant testing fixtures are passive and unable to maintain a constant compressive load; as the cage expands, it compresses the spring further, and by Hooke's Law this causes artificial force spikes that corrupt preclinical data. This project presents a closed-loop, PID-controlled compressive fixture that retrofits onto standard Universal Testing Machines at approximately $500, using an Arduino microcontroller, a linear actuator, and a 500 lbf load cell to actively maintain precise compressive force throughout the full expansion cycle. PEEK interfaces mimic the bone and clinical environment inside a patient's body while preserving imaging access during testing. PID gains were determined empirically, and the final PI configuration (Kp=10, Ki=0.5, Kd=0) achieved stable force control, with a real-time Python interface displaying live force data and automatically saving results as a CSV file. This device offers a cost-effective, imaging-compatible alternative to expensive biaxial testing machines for spinal device validation.