MODELING BRAIN DAMAGE IN FOOTBALL IMPACTS IN FULL BODY PHYSICS-BASED SIMULATIONS. Cassidy, C.R. & Horstemeyer, M.F., School of Engineering, Liberty University, 1971 Liberty Avenue, Lynchburg, VA 24515 This study employs a novel approach using the Computational Anthropomorphic Virtual Experiment Man (CAVEMAN) model, combined with a sophisticated Internal State Variable (ISV) brain constitutive material model, to recreate and analyze the biomechanical response of the brain in scenarios mimicking real-life impacts. Specifically, the research focuses on reconstructing the incident involving Aaron Hernandez, aiming to understand the biomechanical brain response under similar conditions. The ISV model is calibrated using compression tests on fresh porcine brains, ensuring a realistic simulation of brain tissue behavior under impact. Subsequently, the calibrated model is integrated into CAVEMAN to simulate the dynamics of the brain during impact, employing 3D Finite Element (FE) analysis to achieve high-fidelity results. By focusing on real-world scenario recreation, the research aims to uncover detailed insights into the biomechanical processes leading to brain damage, offering a multiscale, physics-based analysis that is at the forefront of current research in brain injury mechanisms. The goal is to enhance our understanding of brain injuries in sports, potentially guiding the development of improved safety measures and protective gear. Author contact: Caleb R. Cassidy, crcassidy@liberty.edu.