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Finite Element Modeling of Impact and Injury to the Lower Extremity REBECCA FIELDING, REUBEN KRAFT, Pennsylvania State University, ANDRZEJ PRZEKWAS, X.G. TAN, Computational Fluid Dynamics Research Corporation — An underbody blast (UBB) is the detonation an explosive device under a military vehicle. Such incidents can lead to severe injuries in the lower extremities. Research has been conducted at a variety of anatomical levels to better understand the mechanisms that lead to injury in the lower extremity. A finite element model of the lower leg was validated against experimental data for vertical loading at 5 m/s. This model was used as a basis for full leg simulations and preliminary fracture modeling. In UBB events, the foot and ankle, particularly the understudied calcaneus, may sustain significant damage. A cadaveric calcaneus was scanned to a resolution of 55 microns using an industrial microCT scanner. This data was used to generate a 2D finite element mesh of the calcaneus that included marrow, trabecular bone, and cortical bone. Loading conditions for the calcaneus were based on results of the lower leg simulations. The calcaneus model was used for exploratory investigations into the effect of trabecular structure and material interaction on patterns of stress propagation and potential fracture paths. As research continues, the aim is to develop model accuracy and resolution at micro- and macroscale levels for a thorough understanding of injury mechanisms.

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