FEM MODELING Of PEDIATRIC BRAIN INJURY MODELING UNDER CYCLIC LOADING

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In this talk we will report on computational simulations of cyclic loading of infant head-brain for large time durations (up to 2 seconds) structures using explicit dynamic finite element methods. Several such simulations have been carried out in the context of impact injury – see for e.g. King et. al.[1] However few of these efforts have been directed at longer duration events and pediatric injury. We will use these simulations to explore multiple injury hypotheses. Starting with CT/MRI image data we construct patient specific finite element models of the brain-skull structure using segmentation tools to identify different regions, membranes and substructures. These are then meshed with a combination of solid and shell elements. Using a viscoelastic model of brain tissue obtained by Donnelly and Medige [2] we test several injury mechanism hypotheses. Preliminary results indicate that patterns of damage for these longer duration cyclic loads , postulated here to be dependent on cumulative strain rates, may be very dependent on the nature and duration of the loading and differ significantly from the well studied impact damage. We will also present early work on applying error control strategies to these simulations using measures of error reported for instance in Patra and Ramakkagari [3].

References

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[3] A. Patra, and V. Ramakkagari, Goal Oriented Error Estimates for Lagrangian simulations of Hypervelocity Impact, Vth USNCCAM, Dearborn, MI, August 2001.