Material Point Method Simulation of Ballistic Trauma

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The Material Point Method (MPM), a generalization of Particle in Cell / Fluid Implicit Particle Method to solid mechanics, is very effective for simulating various materials in the presence of large deformation and topology change. It is adapted here to simulate ballistic trauma in human tissue injuries. Simulation inputs are bone, muscle and skin particles numerically sampled from a three-dimensional reconstruction of magnetic resonance imaging (MRI) images of an actual patient. Different parts of the geometry are assigned with their corresponding mechanical properties. External projectiles are treated as collision objects. We use MPM to simulate the dynamics during high speed impacts. Tissue damage is automatically generated with our elastoplastic models during the simulation, resulting in realistic visual results of the virtual injury. We demonstrate the simulation results in several injury scenarios with rendered 3D videos.

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