

عنوان مقاله:

Computational Simulation of Neuronal Cell Membrane/Cortex Response under Blast Loading

محل انتشار:

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خلاصه مقاله:

A thorough analysis of blast conditions is a significant field in aerospace engineering and specifically is investigated in novel space technologies. Traumatic brain injury states to brain damage causing from sudden trauma. This is very important to understand the mechanism and effects of such damages to the brain toward the treatment for injuries. Change in membrane permeability and membrane disruption might be the earliest cell response to a blast load. In this research, a computational framework for considering the response of membrane/cortex of neuronal cell was presented. Two common types of blast loads including Friedlander waveform and laser-induced experimental platform were considered. The negative pressure phase was also considered in both types of mentioned blast loads. Finite elements method with fluid-structure interactions were used in the simulation. Membrane/cortex was assumed to follow visco-hyperelastic and visco-elastic mechanical behavior. In order to follow the mentioned mechanical behavior, first order generalized Maxwell model with Neo-Hookean and elastic models were used. The Hugoniot/Mie-Gruneisen equation of state was used for propagation of shock waves in the water. The pressure and von Mises stress results were captured in the range of 1-22 pascal. The results showed that the peak overpressure and duration of the positive phase of blast loads play an important role in membrane/cortex response. Furthermore, the negative pressure phase affected the results. The results also indicated that changing the material behavior and blast loads had a slight influence on the results. Finally, the results could be effective in the potential treatments after traumatic brain injury .and also diagnosis of brain damages

کلمات کلیدی:

neuronal cell membrane/cortex - blast load - finite elements - cell mechanics

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