Fast & Accurate: An accelerated fluid-structure interaction method using Viper::Blast and OpenRadioss

James Wurster[1], Christopher Stirling[1], Andrew Nicholson[1], Peter McDonald[1]

[1] Viper Applied Science

When a blast strikes a structure, how fast does the structure react? Often, the structure's response lags behind the rapid blast, allowing for a simplified, uncoupled simulation. But in scenarios where the structure's reaction is nearly as quick as the blast, such as in large-scale or close-proximity explosions, uncoupled models fall short. Here, a fully coupled fluid-structure interaction (FSI) simulation becomes essential.

FSI simulations are notoriously complex, demanding intensive computational resources for both the fluid and structural domains, especially when these systems interact dynamically. However, the need for fully coupled simulations shouldn't mean sacrificing efficiency or ease of use or accuracy.

In this talk, we introduce Viper::Defence, a powerful yet user-friendly solution for fast and accurate FSI simulations. By leveraging Viper::Blast for fluid dynamics on the GPU and OpenRadioss for structural analysis on the CPU, Viper::Defence optimizes the strengths of each platform to utilise the entire computer. This dual approach enables large, fully coupled simulations to run efficiently (even on a personal laptop!) without compromising accuracy or user experience. Here, we'll specifically discuss the workflow of Viper::Defence and how it has been optimised for accessibility to the end user. We'll briefly discuss our methodology and provide an overview of our interaction algorithms. Finally, we'll show validation and demonstration cases, illustrating the power of our fast and accurate method that will ultimately democratise FSI modelling!