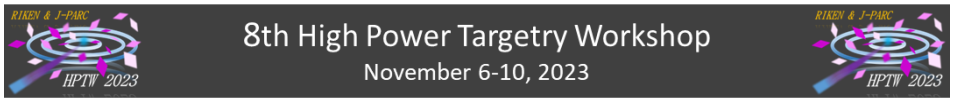

Contribution ID: **53** Type: **Contributed Oral**

Coupling mercury/ bubble material model in the pulse simulation to predict strain on the Spallation Neutron Source target vessel with gas injection

Tuesday, 7 November 2023 15:00 (15 minutes)

SNS targets have been operating with helium microbubble gas injection since 2018. The measurements during in situ testing showed that the strain response of the mercury target vessel significantly decreased with gas injection. Strain reductions range from 40% to 75% for targets operating with gas-injection rates between 2-3 standard liters per minute (SLPM). These strain reductions are expected to significantly improve the fatigue life of the mercury target vessel. The achieved suppression of pulse response and cavitation damage with gas injection is a cornerstone of the upgrade basis to the redesigned mercury vessel for 2MW operations coming with the Proton Power Upgrade (PPU) project.
Development of simulation techniques that account for the benefits of gas injection adds a considerable challenge over the current technique used to simulate a target without gas. A combined mercury/bubble material model based on the Rayleigh–Plesset (R-P) equation was developed to improve simulation of the response of a structure containing liquid and gas by incorporating bubble growth volume feedback. This talk will detail the implementation of the mercury/bubble material model in the pulse simulation of a jet-flow target design. The newly developed simulation technique combines the current no-gas mercury material model for no-gas regions and the mercury bubble material model for the regions with gas bubbles together. The results of the strain response simulation are promising with the new techniques for the targets operating with gas injection. The challenges of the technique development will also be discussed, for example, the bubble size distributions are crucial for the simulations but are still an area of active research.

Themes for the contribution

4 Target design, analysis, and validation of concepts:

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