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Impact of seafloor reflection on vibration of naval equipment subjected to underwater explosion loads

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Underwater explosions (UNDEX) generate shock waves and bubble oscillations that propagate through marine structures, inducing vibrations that can compromise the performance and reliability of onboard equipment. In shallow waters or near the seafloor, wave reflections play a crucial role in altering the intensity and frequency content of the transmitted loads, affecting the structural response and operational safety of naval and offshore systems.
This study investigates the influence of seafloor reflection on the effectiveness of traditional resilient mounting systems in mitigating structure-borne vibrations induced by UNDEX events. A coupled acoustic-structural numerical approach, implemented in ABAQUS CAE, is employed to analyze a foundation-resilient-mass subsystem mounted on a patrol vessel. The explosion scenario considers a charge positioned near the seabed, capturing the effects of wave reflection on the transient response of the onboard equipment.
Numerical simulations focus on the interplay between direct and reflected shock waves, assessing how the modified loading conditions impact the attenuation performance of resilient mountings. Results highlight the potential amplification of specific frequency components due to reflection phenomena, leading to increased structural stress and vibration levels. These findings provide insights into the limitations of traditional vibration isolation strategies and suggest avenues for improving anti-shock and anti-vibration solutions in naval engineering.

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