PREDICTION OF BLAST CHAMBER RESPONSE USING HARMONIC TRANSFER FUNCTIONS IN THE FREQUENCY DOMAIN

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ABSTRACT

A method of predicting the elastic dynamic response of a blast containment chamber utilizing frequency domain dynamic analysis to internal blast loading is presented. The chamber was tested with a small charge that was increased incrementally to determine the design basis limit for the chamber empirically. Dynamic response of the chamber and the blast load from a small charge are converted into the frequency domain to determine a harmonic transfer function. Applied blast loads from a larger charge weight are then converted into the frequency domain by fast Fourier transform and the blast response of the chamber is predicted utilizing the harmonic transfer function. The dynamic response predicted by the harmonic transfer function is converted back to the time domain by inverse fast Fourier transform and the time history compared with the test result. The chamber response to subsequent tests was predicted with reasonable accuracy showing a good correlation between the forced and free vibration response of the chamber, chamber vibration modes, and peak μ-Strain. Blast loads predicted by computational fluid dynamics can be utilized used with the harmonic transfer functions to quickly predict chamber response without the need to perform additional finite element analysis or additional fluid structure coupled simulations.