

Overview on blast resistance assessment of structures: finite element simulations and fragility analyses

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Abstract

An overview on resistance assessment of structures subjected to impulsive loads is presented in this seminar. Finite element simulations are carried out, mostly using LS-Dyna[®], for assessing the behavior of reinforced concrete and insulated panels (sandwich panels) loaded by blast. Furthermore a probabilistic framework, originally used in earthquake engineering, is applied to blast engineering. The probability of failure assessed for a reinforced concrete panel and a built-up blast resistant door is calculated using Monte Carlo simulations (unconditional approach) and by means of fragility analyses (conditional approach).

One of the presented finite element analyses has been awarded in a simulation contest sponsored by the USA National Science Foundation and American Concrete Institute. The carried out finite element simulations predict with satisfying accuracy the response of structures subjected to impulsive load. Therefore those modelling techniques can be used to validate the design made by simplified analyses such as the Single Degree of Freedom SDOF analysis.

The presented probability approach for blast loaded structure is an innovative application of the performance-based engineering to blast design. The proposed probabilistic framework, to develop further, shows the feasibility to apply a probabilistic design to blast loaded structure even using simplified mechanical models such as the mentioned SDOF analysis. Furthermore a safety factor for blast design is proposed as well.

Short biography

Dr. Pierluigi Olmati obtained his Ph.D. degree in Structural Engineering at Sapienza University of Rome (IT) in March 2014. During his Ph.D. program he has been visiting scholar at Lehigh University (USA) and National Technical University of Athens (GR). In 2014-15 he worked first as researcher at University of Surrey (UK) and later as design engineer at AKT II (structural engineering consultant, UK). In November 2015 Dr. Olmati has been awarded with a fellowship of the Japan Society for the Promotion of Science and he is hosted by Prof. Yukio Tamura and Prof. Akihito Yoshida at Tokyo Polytechnic University - Wind Engineering Center. Research interests: numerical and experimental evaluation of structures subjected to impulsive loads, probabilistic frameworks applied to impulsive loaded structures.

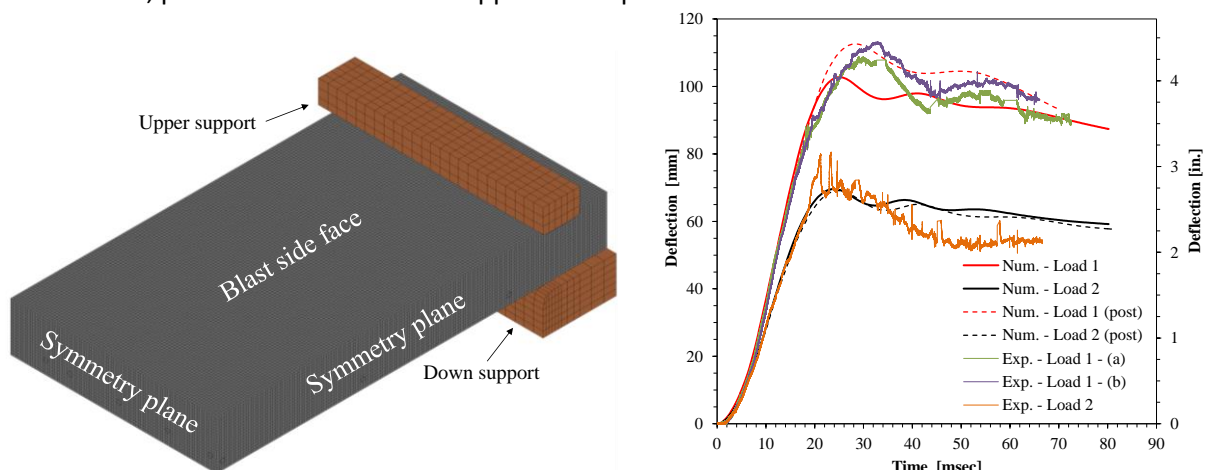


Figure 1: finite element model of the reinforced concrete panel tested in a shock tube (left), experimental and simulated middle span deflection of the panel (right)