Modelling and Simulation of Impact loads of Adhesively Bonded Cement-based Composites

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Objectives / Description / Main outcomes

In the last decades, the use of innovate materials for blast, impact and fire resistant of structures are intensively increased in construction industries which highlights the importance and need of appropriate simulation and design methods for these kind of materials and their bondingunder thermal and extreme dynamic loadings. In this short report, the behavior of Ultra High Performance Concret (UHPC) materials is first investigated under the effect of impact loading, which is an indirect validation for the efficiency of finite element model for the structure under blast loading. The results of virtual impact tests (Fig. 1) revealed the promising capability and accuracy of finite element modeling, to further explore the blast resistance of the UHPC and their bonding with other construction materials. In doing so, the finite element model is further extended to find the response of structure under the effect of blast loading (Fig. 2), by using the Multi-Material Arbitrary Lagrangian Eulerian (MM_ALE) where the explosive, air and structure are explicitly modelled providing more accurate results than other approaches of blast loading, such as Conwep and empirical formulations, where the blast load is idealised as an exponential function of time. The results showed that the numerical model using LS-DYNA has sufficient accuracy and efficiency to predict the behavior of such structures under the effect of extreme dynamic loading. It should be noted that the current report is a short report on the progress of the work in accordance with the BAM project entitled Blast and Fire Resistant Material funded by the Research and Innovation Foundation of Cypurs. Ongoing experiments on composite materials in the frame of BAM will provide the finite element procedure with the necessary material properties to further improvement, which will eventually lead to a robust simulation method.

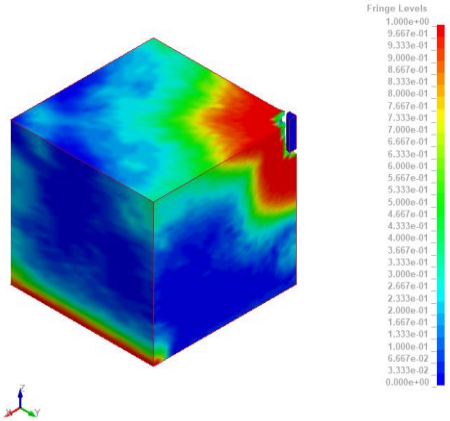

Fig.1: Impact load with 20J energy

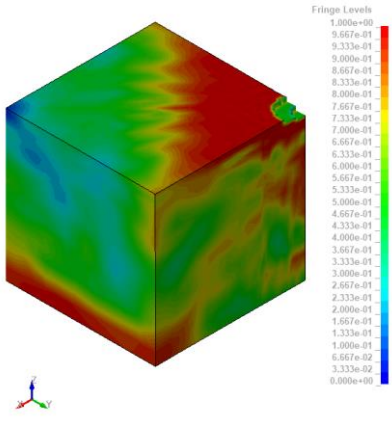

Fig.2: Blast load with 7.5 gr TNT

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