RESPONSE OF STRUCTURAL ELEMENTS UNDER NON-UNIFORMLY DISTRIBUTED DYNAMIC LOADS

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ABSTRACT

Determination of the structural response of a structural element under blast loading is of interest to vulnerability / lethality (V/L) studies of military operations in urban terrain. These studies require a quick and easy to use method to simulate the structural response of e.g. a wall under non-uniform loading conditions. The single degree of freedom model (SDOF) provides a very efficient method to schematize and predict the response of structures subjected to dynamic loads. SDOF-model parameters are for many element types tabulated in textbooks. However these parameters are derived for uniform loading conditions. In order to model the non-uniform loading conditions, applicable for the V/L studies, two approaches are presented in this paper: an extension on the SDOF method for non-uniform loading, and a discrete multi degree of freedom method (MDOF). Both methods are introduced and initially tested on a basic linear elastic scenario with non-uniform loading conditions. The results from both methods are compared with each other, regarding to their modelling capability, computational effort and input requirements. Basic scenario results showed a small difference in maximum deflection between the two methods. The extended SDOF method provides less detail and is faster to run, while the MDOF method includes more detail, such as higher Eigen modes, but takes longer to run. The two presented methods can efficiently analyse the linear elastic structural behaviour of a structural element subjected to non-uniform blast loading.