

Summer Research Program 2011/2012

Project Title

An innovative non-discretisation 3D model for nonlinear analysis of steel frames subjected to blast loading

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Objective

This project aims to develop a novel numerical 3D model to describe the nonlinear behaviour of steel frames subjected to explosion.

Description

The methodology will be based on a semi-analytical non-discretisation numerical formulation for the non-linear dynamic analysis of steel frames subjected to loading produced by an explosion. For the mechanical-based formulation, the steel member will be modelled as being restrained at its ends by translational and counterpart rotational springs which simulate semi-rigid joints in a frame. The modelling of the cross-section as comprising of elastic and inelastic domains will allow for the spread of yielding to be modelled accurately, whilst the effects of large displacements and the rate-dependant effect of steel material due to rapid dynamic loading will be taken into account.

The generic technique, which will be developed in this research work, will be shown to agree with solutions given by finite element modelling using ABAQUS whilst it will provide a computationally superior formulation to that of commercial finite element packages. In addition, it will provide a more efficacious formulation to those of conventional plastic zone and plastic hinge methods, while it has the potential to be used as a platform for structural analysis and design in which scenarios of progressive collapse are important.