

Summer Research Program 2011/2012

Project Title

An innovative non-discretisation 3D model for nonlinear analysis of steel frames at elevated temperatures

Supervisor: Dr Amin Heidarpour

Email: amin.heidarpour@monash.edu

Phone: 99024435

Department: Civil Engineering Department

Objective

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

Description

The methodology will be based on a non-discretisation semi-analytical formulation of a generic steel cross-section with elastic and plastic parts. The model will incorporate moderately large displacements effects as well as material nonlinearity to assess the performance of steel frames exposed to thermal loading in a compartment fire. It will consider the yielding and development of catenary action effects which occur with an increase in the temperature. The effects of the thermal gradient along the length of the member will be taken into account, in which the cross-section will be subjected to an arbitrary thermal profile. Degradation of the stiffness and yield strength with increasing temperature will be simulated using empirical retention functions given in Australian Standards while the technique will be shown to be part of the class of boundary value problems in engineering mechanics.

The generic technique, which will be developed in this research work, will be shown to agree with solutions given by ABAQUS finite element modelling whilst it will provide a computationally superior formulation to that of commercial finite element packages, and will provide a formulation which may be used as a platform for structural design and evaluation.