

STSM Scientific Report

COST Action TU0904

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Visiting student: Ioan BOTH
Faculty of Civil Engineering
"Politehnica" University of Timisoara
Timisoara, Romania

Host: Prof. Leslaw KWASNIEWSKI
Faculty of Civil Engineering
Warsaw University of Technology
Warsaw, Poland

Period of STSM: 16/09/2013 – 27/09/2013

Purpose of the visit

The main purpose of the STSM was to perform a numerical simulation of a composite column subjected to thermal and structural loading.

Description of the work carried out during STSM

The current STSM is focused on simplifying the numerical simulations for a composite column in order to obtain benchmark information that can be used as a startup for other composite elements analysis.

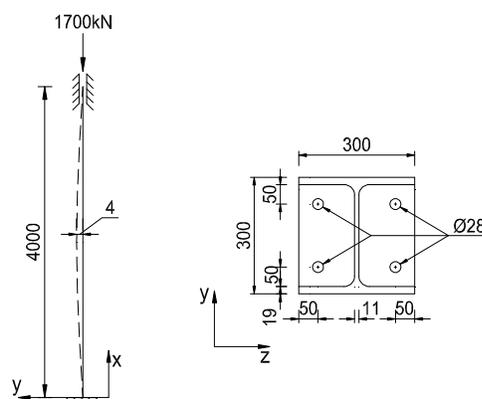


Fig. 1 Composite column

The example chosen for analysis consists of a concrete column having the cross-section a partially incased steel profile having four reinforcing bars. The column has an initial imperfection of

4mm following a parabolic path and it is subjected to compression. The thermal action is considered through a transient heat transfer analysis.

The work started by performing a steady state analysis using elementary input data for the material: Young's Modulus, yield stress, Poisson's Ratio and thermal expansion. The thermal action was considered as temperature boundary condition, resulting a uniform temperature on the cross-section. The results show the mechanical response of the column: deflection at mid-height and vertical deflection at the top of the column.

In order to have a more realistic case the temperature within the cross-section should not be constant. Thus, it was considered also the conductivity and the specific heat of each material.

Considering the thermal properties for steel profile, rebar and concrete, the temperature on the cross-section depends on the mesh density and it presents the isotherms in the following figure.

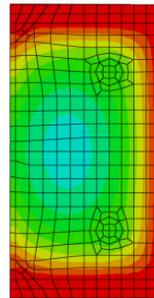


Fig. 2 Temperature distribution (Abaqus results)

By performing a transient analysis, the mechanical response is different and the temperatures in different locations on the cross-section may also be quantified.

The column was modeled using 3D elements and in order to reduce the time analysis, symmetry conditions were defined.

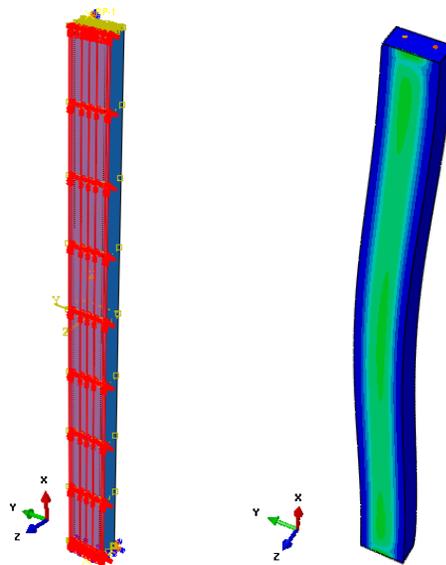


Fig. 3 Symmetry conditions on 3D and deflected shape of the analysis

Description of the main results obtained

Due to the step by step analysis of the model by starting from a simple model to a more complex one there can be observed the results' changes and the influence of thermal properties of material.

Future collaboration with host institution (if applicable)

The collaboration with Warsaw University of Technology and especially with Prof. PhD. Leslaw Kwasniewski, established a few references regarding the aims for future research. For the future, collaboration may continue by comparing results for different structures subjected to thermal loadings, in order to have validation examples as well as benchmark input data and results for a more advanced research.

Foreseen publications/articles resulting or to result from the STSM

Dissemination of the results obtained in the current STSM may refer to benchmark studies for composite elements.

PhD. eng. BOTH Ioan

A handwritten signature in blue ink, appearing to read 'Both', is positioned below the typed name.