Title: The heat transfer problem in composite structures under the action of fire

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Fire in buildings is a situation that has worried the man since the beginnings of buildings. However, the study of the behaviour of the structures and the ways of protecting the personal and material integrity, has started just a few years ago. The Eurocodes for structural design in situation of fire were written in the 90’s according to the knowledge by that time. Substantial research has been carried out since then in modelling the fire conditions and the behaviour of the composite structures.

In this context, the aim of the present work is to understand the heat transfer problem in fire situations and the way the materials used in composite structures change their properties because of the heat action.

The aims of this study are two: the calibration of the calculation model and to compare the results obtained with the different ways of determining the temperature distributions in some kinds of composite structures. To achieve these objectives, this study has been divided into the following parts:

Firstly has been reviewed the literature dealing with several aspects related to the heat transfer problem in composite structures under fire conditions. In chapter 2 the way the actions in fire conditions should be considered and the evolution of the material’s properties is described. This chapter is completed with the appendix 2, where the different simple calculation models, used in this study, are explained.

The following chapter is an introduction to the theory used in the advanced calculation models to obtain the temperature distributions, and the way, the model used in this study (COMET), solves the Fourier law for the heat transfer. Moreover, the COMET calibration process is described in appendix 1, where all the iterative process to reach a good agreement with test results, is described.

Finally the COMET advanced calculation model has been used to simulate the action of FIRE in sections which are considered in the reviewed literature. The sections analysed in most cases have a simple calculation model described in ENV 1994-1-2:1994, but we have studied some cases not considered in ENV because of the interest of that kind of sections. This chapter includes the results analysis of the different methods used to study the evolution of the temperature in the sections.