VALIDATION OF THERMAL IMAGING AND COMPUTER SIMULATIONS USING METHOD OF FUNDAMENTAL SOLUTIONS FOR CORNER WINDOW

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1. Introduction

In this paper the validation of the Method of Fundamental Solutions (MFS) with the use of infrared thermovision images are presented. MFS is a meshless method that stands out with the simplicity of implementation. What is more, the preparation of data for calculations is not as time-consuming as in other numerical methods. This method allows to select parameters in a way that enables to obtain a solution with satisfactory, assumed and defined accuracy. The results are received in the form of continuous functions, which enables numerical analysis, e.g. determination of stresses and strains based on temperature change [4].

For the analysed object the results of the numerical method (obtained temperature fields) will be validated using thermovision temperature measurement. Infrared thermography is a very convenient method thanks to its main advantages, such as: simplicity and non-invasiveness. Thanks to these features tests using thermal imaging cameras are applicable in almost every field [1, 3, 6].

2. Measurement equipment and description of the test object

The Method of Fundamental Solutions is used to solve the boundary problem with the heat transfer equations for the window (barrier consisting of three layers with constant thermal conductivity coefficients of each layer). In this case the inverse problem is analysed, it means that the temperature is determined on the edge of the considered area. The obtained results are compared to the thermogram taken with the thermal imaging camera Testo thermal imager 875i with the following features: detector 160x120 pixels, resolution technology SuperResolution - up to 320x240 pixels, thermal sensitivity of <50 mK.

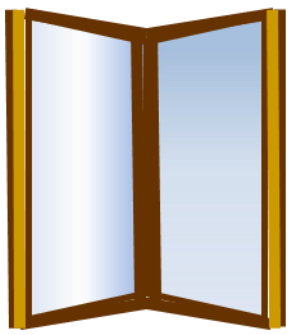

Fig. 1: Test object - corner window (the inside of the window)

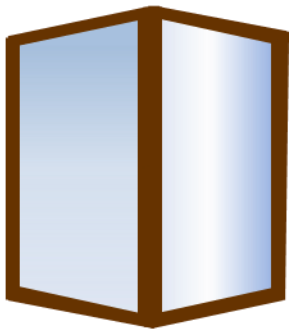

Fig. 2: Test object - corner window (the outside of the window)

Below, a temperature distribution (Figure 3) on the one side of the outside of the window with the outdoor temperature of 11° C is presented.

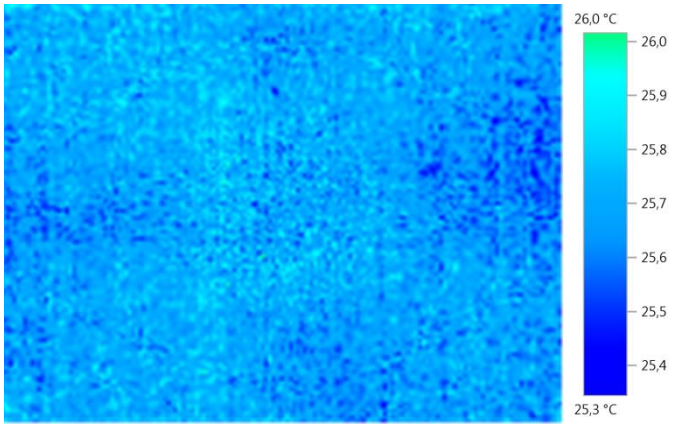

Fig. 3: Test object - corner window
(the teperature distribution on the outside of the window)

The above temperature distribution is a comparative model for the obtained results of computer simulation using MFS.

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