The Modelica Thermal Model Generation Tool for Automated Creation of a Coupled Airflow, Radiation Model and Wall Model in Modelica

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This paper presents the Modelica Thermal Model Generation Tool. The aim of this tool is to enable the user to set up a geometrically correct thermal model for complex geometries that allows predicting the impact of heated/heating devices and their location both in terms of airflow pattern and radiation distribution. Using a geometry file exported from CAD software, the tool distributes wall facets, air nodes and computes the long-wave radiant view factor matrix for obstructed and unobstructed surfaces. This information is exported as ready to use Modelica code. The zonal model VEPZO is used to model airflow within a domain (enclosed space). This model allows predicting airflow and air temperature distribution in space on a coarse mesh and thus computes faster than classical CFD computations. Walls are subdivided on the same grid as the zonal model is set upon. For each wall facet, the Modelica Thermal Model Generation Tool computes the view factors to the other facets in the domain.

Comparison of simulated results with test data and application of the Modelica Thermal Model Generation Tool for a room with radiant heating and for the cooling of an aircraft cockpit are presented in this paper.