ANALYSIS OF CONJUGATE HEAT TRANSFER IN STEEL REHEAT FURNACES WITH FOCUS ON DETERMINATION OF RADIATIVE FLUX

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Heat Transfer has been analyzed in a simplified steel reheating furnace with Open Source tools. First, the furnace geometry is constructed and hexahedral meshing is done with Salome[1]. The differential approximation to the method of spherical harmonics (P1) is utilized to model radiative transfer, where the participating gaseous media is modeled as a Weighted Sum of Grey Gases and as a k-Distribution[2]. These two models were implemented in OpenFOAM[3], and the P1 method was modified to work with such global absorption emission models. The simulation is performed with a steady-state heat transfer solver for buoyant, turbulent flow of compressible fluids, including radiation - buoyantSimpleFoam. The flow field and temperature distribution are finally computed and the radiative flux is scrutinized which leads to further work.

In both WSGG and k-Distribution models, the weights for emissivity and absorptivity are allowed to depend on wall and gas temperatures. The weights for WSGG were evaluated from curve fit parameters proposed by Smith et al. [4], while the parameters for k-Distribution have been taken from Modest et al. [5].

Figure 1. Mesh of the furnace, with 39,750 cells


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