

## APPLICATION OF THE CONSERVATIVE DISCRETE TRANSFER RADIATION METHOD TO A FURNACE WITH COMPLEX GEOMETRY

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**ABSTRACT** A conservative form of the discrete transfer radiation method (DTRM) has been applied in a computational fluid dynamics (CFD) simulation of the radiative heat transfer and other phenomena in an experimental furnace. Although the furnace is nearly square in cross section, the modelling of relatively small-sized cooling tubes, aligned beside the walls in the first third of the furnace length, was quite challenging, leading to computationally demanding calculations. The furnace was operated under non-premixed conditions, burning preheated heavy fuel-oil. For combustion simulation a semi-empiric oil combustion model has been applied, while for the evaluation of radiative properties the weighted sum of grey gases model (WSGGM) has been adopted. This work focuses on the assessment of the conservative DTRM behaviour in a CFD simulation of a furnace with moderate complex geometry. The heat fluxes on the domain boundaries and the overall heat balance were of particular interest in this respect. An unstructured computational mesh, consisting of 836951 control volumes, has been used. A simple sensitivity analysis for two different DTRM set-ups – with 4 (1x4) and 8 (2x4) rays per boundary face, respectively – has been performed. More rays, due to a limited computational power, could not be used. The simulation results were compared with available experimental data, showing acceptable level of accuracy, with DTRM able to catch direction dependent shadowing effects on the net-flux rates at the walls, caused by cooling-tubes positioned in front of them. A comparison of the original DTRM formulation vs. the conservative DTRM formulation has been performed as well, showing the superiority of the conservative formulation over the original one.