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Mario Baburić, Alexandre Raulot, Neven Duić

IMPLEMENTATION OF DISCRETE TRANSFER RADIATION METHOD INTO SWIFT CFD CODE

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ABSTRACT

The Computational Fluid Dynamics (CFD) has developed into a powerful tool widely used in science, technology and industrial design applications, whenever fluid flow, heat transfer, combustion, or other complicated physical processes, are involved. During decades of development of CFD codes, scientists were writing their own codes, that had to include not only the model of processes that were of interest, but also a whole spectrum of necessary CFD procedures, numerical techniques, pre-processing and post-processing. That has arrested much of the scientist effort in work that has been copied many times over, and was not actually producing the added value. The arrival of commercial CFD codes brought relief to many engineers that could now use the user-function approach for modelling purposes, entrusting the application to do the rest of the work. This paper shows the implementation of Discrete Transfer Radiation Method (DTRM) into AVL s commercial CFD code SWIFT with the help of user defined functions. Few standard verification test cases were performed first, and in order to check the implementation of the radiation method itself, where the comparisons with available analytic solution could be performed. Afterwards, the validation was done by simulating the combustion in the experimental furnace at IJmuiden (Netherlands), for which the experimental measurements were available. The importance of radiation prediction in such real-size furnaces is proved again to be substantial, where radiation itself takes the major fraction of overall heat transfer. The oil-combustion model used in simulations was the semi-empirical one that has been developed at the Power Engineering Department, and which is suitable for a wide range of typical oil flames.

KEYWORDS

computational fluid dynamics, discrete transfer radiation method, SWIFT, experimental furnace, oil-combustion

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