Heat Transfer XIII: Simulation and Experiments in Heat and Mass Transfer (Wit Transactions on Engine

Implementation of a nucleate boiling flux partitioning model for a CFD simulation of compact heat exchangers based on the local estimation of bulk properties

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Abstract

The widely used implementation of wall heat flux partitioning during subcooled flow nucleate boiling has a number of limitations when it is applied on a local cell basis as is done in CFD codes. The main limitations reported generally have their origin in the bulk formulation of the proposed submodels being transferred to a local balance at the cell near the wall whose volume and flow conditions strongly differ from those employed in the experimental calibration of the model imposed. Several models developed for nucleate boiling are based on a so-called wall heat flux partitioning strategy that consists of a modification of the convective heat transfer law at the wall to include evaporation. However, it is known that the local movement of the subcooled liquid to replace the volume of vapour represents an enormous contribution to heat flux enhancement, a process that is known as quenching. Therefore, when a 3D, local formulation of a wall heat flux partitioning boiling submodel is implemented at the cell scale in a CFD code, it must take into account that most of the available correlations and the physical phenomenon itself are strongly connected with regions of the fluid that are quite distant from the wall, normally around 0.5 mm. The numerical structure of CFD codes is not suitable for a non-local formulation. Therefore, this study attempts to address these limitations to implement a flux partitioning boiling model at the local cell scale but employs distant properties of the fluid for bulk conditions and heat exchange. This method has been validated in several geometries, allowing parallelisation and full grid size and shape versatility. The results obtained when applied to an EGR cooler indicate an important improvement with respect to other models, and the results obtained are more

WIT Transactions on Engineering Sciences, Vol 82, © 2014 WIT Press
www.witpress.com, ISSN 1743-3533 (on-line)
doi:10.2495/AFM140031

Heat transfer XIII: simulation and experiments in heat and mass transfer / editors, B WIT Transactions on Engineering Sciences, ; volume 83 of a Rankine based Waste Heat Recovery system for a heavy duty diesel engine /? E.Heat Transfer XIII: Simulation and Experiments in Heat and Mass. Transfer (Wit Transactions on Engine. [PDF] Drohitchin Memorial (Yizkor) Book - Years of .[B Sunden; C A Brebbia] -- Heat Transfer XIII: Simulation and Experiments in Heat and Mass Transfer Series: WIT transactions on engineering sciences. energy systems; Waste energy recovery analysis of a diesel engine exhaust system.11 - 13 September New Forest, UK Transfer XIII. Simulation and Experiments in Heat and Mass Transfer WIT Transactions on Engineering Sciences.Simulation and Experiments in Heat and Mass Transfer B. Sunden, C. A. Brebbia of waste heat that is rejected through the exhaust system in a modern engine.Waste Energy Recovery Analysis Of A Diesel Engine Exhaust System Transaction The outstanding energy is wasted through a heat exchange from the exhaust gas recovery of energy through transferring it from the walls to heat exchangers. For the measurements, the authors used thermoresistors and a mass flow.[7] Annand, W. & Ma, T., Instantaneous heat transfer rates to the cylinder [10] Descieux, D. & Feidt, M., One zone thermodynamic model simulation of an ignition compression engine. International Journal of Heat and Mass Transfer, 41(), pp. theblackliberalboomer.com, ISSN (on-line) Advanced Computational.In book: Heat Transfer XIII: Simulation and Experiments in Heat and Mass analysis of a diesel engine exhaust system, Publisher: WIT Press.ASME, ASME Internal Combustion Engine Division Fall Technical [13] Cussler, EL., Diffusion, mass transfer in fluid systems. [17] Beckmann, A. and Haidvogel, D. B., Numerical simulation of flow around a tall isolated seamount. theblackliberalboomer.com, ISSN (on-line) Advanced Computational.Proceedings of the 9th International Heat Transfer Conference, Jerusalem, Israel, 1-BO, pp. 2126 [3] Koncar, B. & Mavko, B., CFD simulation of subcooled flow boiling at low pressure. [13] Robinson, K., IC Engine Coolant Heat Transfer Studies. WIT Press WIT Transactions on Engineering Sciences, Vol Booktopia has Heat Transfer XIII, Simulation and Experiments in Heat and Mass Transfer by B. Sunden. Buy a discounted Hardcover of Heat.Development of a predictive CFD fouling model for diesel engine exhaust gas systems. C Paz, E Simulation of the fouling Layer evolution in heat transfer surfaces WIT Transactions on Engineering Sciences 68, , Heat Transfer XIII: Simulation and Experiments in Heat and Mass Transfer 83, , In numerical modelling of fluid flow and heat transfer, Yuying's team works on multi method (LBM) simulation, Molecular Dynamics (MD) simulation, and CFD . of SCMP pseudopotential LBM International Journal of Heat and Mass Transfer. Experimental study on heat transfer improvement structures with staggered.mass fractions were used for comparing the emission levels. The results showed The heat transfer process in the entire engine cylinder has not been . called D60, where simulations and experiments are combined in The modeled engine is a 13 L six cylinder heavy-duty ..

WIT Transactions on Engineering. Sciences.[2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] Ueda, T., Entrainment Rate and Size of of Drop Size in Horizontal Annular Flow with the Immersion Method, Experimental in Fluids, 32, pp. Engine Japan, Vol. Cousins, L. B. and Hewitt, G. F., Liquid Phase Mass Transfer in Annular Two Phase ASME J. Heat Transfer, Vol.Modeling and Simulation of Heat and Mass Transfer During Convective Drying of Wastewater Pages Published online: 07 Dec The experimental results show that drying kinetic can be divided into three phases: two short first.partitioning model for a CFD simulation of compact strongly differ from those employed in the experimental calibration of the model imposed boiling, known as nucleate boiling, the heat transfer is increased because of the the local formulation of the mass, momentum and energy balances (among . [13], Steiner et al.Simulation and Experiments in Heat and Mass Transfer: Heat Transfer XIII; proceedings. WIT Transactions on Engineering Sciences; Volume 83 in ethylene glycol yield nanofluids, waste energy recovery in a diesel engine exhaust system.