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A DISCONTINUOUS GALERKIN METHOD FOR REAL GAS FLOW SIMULATIONS

A. Colombo[1,*], D. Pesenti[1,†], A. Ghidoni[2], D. Pasquale[3], L. Botti[1], and F. Bassi[1]

[1] University of Bergamo, Department of Engineering and Applied Sciences
viale Marconi, 5 - 24044 Dalmine (BG)
{alessandro.colombo, francesco.bassi, lorenzo.botti}@unibg.it, d.pesenti@enginsoft.com

[2] University of Brescia, Department of Mechanical and Industrial Engineering
via Branze, 38 - 25123, Brescia, Italy, antonio.ghidoni@unibs.it

[3] Turboden S.p.A., Via Cernaia, 10 - 25124 Brescia, Italy
david.pasquale@turboden.it

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Nowadays the accurate modelling of real gas effects is relevant for many industrial applications, such as Organic Rankine Cycles (ORC), supercritical CO_2 compressors, and refrigeration systems. Many models have been proposed to predict the thermodynamic properties of fluids in presence of non-ideal effects, but their coupling with CFD codes can be computationally inefficient. The Look-up Table (LuT) approach can represent an efficient alternative, using the thermodynamic model only at a preliminary level to compute a subset of thermo-physical properties to store in the grid nodes. In this work a high-order accurate discontinuous Galerkin solver has been coupled with a LuT (built with a quadtree algorithm and the CoolProp library [1]) for the numerical simulation of fluid flows in presence of non-ideal effects. Inspired by the approach proposed in [2], the properties of the LuT are represented by picewise polynomial functions. The LuT accuracy can be enhanced adopting a h/p refinement strategy. Preliminary results in the computation of the flow through a 2D nozzle blade of an existing ORC turbine operated with the Siloxane MDM (OctamethyltriSiloxane) as working fluid are presented. Two operating conditions have been considered, characterized by an expansion starting from subcritical and supercritical conditions.

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† *currently affiliated with Enginsoft S.p.A., Parco Tecnologico Kilometro Rosso, via Stezzano 87 - 24126 Bergamo, Italy*