BARBARA RE: List of published work

1 Publications in peer-reviewed scientific journals

[1] B. Re & A. Guardone. An adaptive ALE scheme for non-ideal compressible fluid dynamics over dynamic unstructured meshes. *Shock Waves* 29 (2019) 73–99. (doi).

My contribution: I was the main author of the paper, I modified the flow solver to deal with non-ideal gas models, I run the simulations and post-processed the results.

[2] B. Re, C. Dobrzynski & A. Guardone. Assessment of grid adaptation criteria for steady, two-dimensional, inviscid flows in non-ideal compressible fluids. *Applied Mathematics and Computations*. 319 (2018) 337–354. (doi).

My contribution: I developed the procedure to compare the adaptation criteria, I managed the simulations from the set-up to the post-process, and I wrote the first version of the paper.

[3] B. Re, C. Dobrzynski & A. Guardone. An interpolation-free ALE scheme for unsteady inviscid flow computations with large boundary displacements over three-dimensional adaptive grids. *Journal of Computational Physics*. 340 (2017) 26–54. (doi).

My contribution: I was the main driving force in this work: I performed all the required software development, I devised and performed the numerical tests, I wrote most of the paper.

[4] B. Re, R. Armellin, N.R. Nannan & A. Guardone. Efficient evaluation of vapour-liquid equilibria from multi-parameter thermodynamic models using differential algebra. *Journal of Computational and Applied Mathematics*. 273 (2015) 404–413. (doi)

My contribution: I did the analytical work and the numerical tests, then I gave a substantial contribution in the writing of the paper.

2 Conference proceedings

2.1 Peer-reviewed conference proceedings

[1] R. Abgrall, P. Bacigaluppi & B. Re. On the simulation of multicomponent and multiphase compressible flows. In *ERCOFTAC Bulletin n. 124 Theme issue on Non-ideal Compressible Fluid Dynamics: present and future challenges*, 2020, accepted, to appear. (arXiv copy)

[2] B. Re & R. Abgrall. Non-equilibrium Model for Weakly Compressible Multi-component Flows: the Hyperbolic Operator. In *Non-Ideal Compressible-Fluid Dynamics for Propulsion and Power, Lecture Notes in Mechanical Engineering*, eds. F. Di Mare, A. Spinelli, M. Pini, 2020. (doi)

[3] B. Re, A. Rurale, A. Spinelli & A. Guardone. Preliminary design of a supercritical CO_2 wind tunnel. *Journal of Physics: Conference Series*, 821:012027 (2017). (doi)

[4] B. Re, A. Guardone & C. Dobrzynski. Preliminary results from an adaptive conservative scheme for three-dimensional Euler equations on dynamic meshes. In *Conference Proceedings of the YIC GACM 2015*, eds. S. Elgeti and J.-W. Simon, RWTH Aachen University, 2015. (pdf)

2.2 Contribution to conference proceedings books

[1] L. Cirrottola, G. Quaranta, B. Re, C. Dobrzynski & A. Guardone. Numerical simulation of nonclassical aileron buzz over 3D unstructured adaptive meshes. In *Proceedings of the ECCM6-ECFD7 2018*, ed. R. Owen, R. de Borst, J. Reese, C. Pearce, CIMNE, 2020. (pdf)

[2] B. Re & A. Guardone. Fluid-Structure simulation of a piston shock-tube using an adaptive ALE scheme in the non-ideal compressible-fluid regime. In *Advances in Critical Flow Dynamics Involving Moving / Deformable Structures, Notes on Numerical Fluid Mechanics and Multidisciplinary Design*, eds. M. Braza, K. Hourigan, M.S. Triantafyllou, 2020, in press. (book)

[3] L. Cirrottola, A. Froehly, A. Guardone, G. Quaranta, B. Re & M. Ricchiuto. R-adaptation for unsteady compressible flow simulations in three dimensions. *Proceedings of ADMOS 2019*. (pdf)

[4] B. Re, C. Dobrzynski, & A. Guardone. Numerical simulation of shock-tube piston problems with adaptive, anisotropic meshes. In *Proceedings of COUPLED PROBLEMS* 2017, ed. M. Papadrakakis, E.Onate, B.Schrefler, CIMNE, 2017. (pdf)

[5] B. Re, A. Guardone & C. Dobrzynski. An Adaptive Conservative ALE Approach to Deal with Large Boundary Displacements in Three-Dimensional Inviscid Simulations. In *55th AIAA Aerospace Sciences Meeting*, 2017. (doi)

3   Theses

[1] B. Re, **PhD Thesis**.*An adaptive interpolation-free conservative scheme for the three-dimensional Euler equations on dynamic meshes for aeronautical applications*. (pdf)

An innovative adaptive scheme for unsteady, inviscid flow simulations of three-dimensional moving-body problems is proposed. Grid connectivity changes due to mesh adaptation are described as series of continuous deformations of the finite volumes that compose the domain, so that the solution on the new grid is recovered within the arbitrary Lagrangian-Eulerian framework without any explicit interpolation, and the Geometric Conservation Law is fulfilled by an appropriate computation of the grid velocity. Node insertion, deletion, relocation, and edge swap are used both to capture flow features as shock waves and shear layers, and to preserve mesh quality when dealing with moving boundaries. The proposed conservative adaptive strategy has been implemented in the CFD software *Flowmesh* and underwent a thorough validation including reference and complex unsteady tests.

External referee: V. Dolejsi (Charles University Prague, Czech Republic)

[2] B. Re, **Master Thesis**. *Taylor expansions of the Vapor−Liquid Equilibrium curve*
(Original title: Espansioni in serie di Taylor della curva di saturazione liquido−vapore) (pdf)

Differential algebra techniques are used to obtain approximations of the vapor-liquid equilibrium curve that provide a good accuracy but a low computational cost. Fourth−order Taylor expansions are derived from the Span−Wagner equation of state (EOS) for carbon dioxide, butane, methane, and propane. The proposed technique guarantees the thermodynamic consistency with the underlying EOS and it can be applied to different thermodynamic models, both technical and reference ones.

4   Contributions to conferences

4.1   Talks at international conferences

[1] Numerical simulation of weakly compressible multiphase flows with a Baer-Nunziato type model. *WCCM-ECCOMAS 2020*. Paris, France. 19−24 July 2020 (accepted, post-poned).

[2] Numerical Simulation of Weakly Compressible CO2-flows With Cubic Equations of State. *ESCO 2020*. Online conference. 8−12 Jun 2020.

[3] A diffuse interface method for weakly compressible multiphase flows based on the Baer and Nunziato model. *MULTIMAT 2019*. Trento, Italy. 9 − 13 Sept 2019.

[4] An Interpolation-free Adaptive ALE Approach with Multi-step Time Schemes. *SIAM-CSE 2019*. Spokane, USA. 25 Feb − 1 Mar 2019.

[5] A non-equilibrium model for weakly compressible multi-component flows. *NICFD 2018*. Bochum, Germany. 4−5 Oct 2018.

[6] An interpolation-free approach to exploit mesh adaptation within the ALE framework. *ADMOS 2017*. Verbania, Italy. 26−28 Jun 2017.

[7] An interpolation-free mesh adaptation approach for unsteady inviscid flows in aeronautical applications. *FEF 2017*. Rome, Italy. 5−7 Apr 2017.

[8] An Adaptive Conservative ALE Approach to Deal with Large Boundary Displacements in Three-Dimensional Inviscid Simulations. 9−13 Jan 2017. *AIAA SciTech 2017*. Grapevine, USA.

[9] Preliminary design of a supercritical CO2 wind tunnel. *NICFD 2016*. Varenna, Italy. 20−21 Oct 2016.

[10] An Innovative CFD Tool to Solve the Euler Equations Within the Finite Volume ALE Framework Over Adaptive Grids. *ESCO 2016*. Pilsen, Czech Republic. 5−10 Jun 2016.

[11] An adaptive conservative scheme for three-dimensional Euler equations on dynamic meshes. *YIC GACM 2015*. Aachen, Germany. 20−23 Jul 2015.

[12] Numerical Simulation of Under-expanded Jets of Dense Gases With an Adaptive Finite Volume Method. *ESCO 2014*. Pilsen, Czech Republic. 15−20 Jun 2014.

[13] Evaluation of the Vapor-liquid Equilibrium of Multi-parameter Thermodynamics Models Using Differential Algebra. *FEMTEC 2013*. Las Vegas, USA. 19−24 May 2013.

4.2   Posters at international conferences

[1] A GCL-compliant Residual Distribution Scheme for Moving Grids. *ESCO 2020*. Online conference. 8–12 Jun 2020. **Best Poster Award**

[2] Transient multi-phase flows at Low-Mach. A novel simulation tool for weakly compressible flows of CO_2-rich mixtures. *TCCS-10*. Trondheim, Norway. 17–19 June 2019.

4.3   Invited talks at workshops and seminars

[1] Diffuse interface methods and conservative mesh-adaptation: how to combine their potential for highly accurate multiphysic simulations?. At *Cavendish Laboratory, University of Cambridge*, UK. 12 Dec 2019.

[2] A new numerical method for multiphase flow of CO2 in pipes. *NCCS Consortium Days 2019*. Trondheim, Norway. 22 – 23 Oct 2019.

[3] Mesh adaptation for unsteady problems and low-Mach multiphase flow modeling. At *Dipartimento di Ingegneria Civile, Ambientale e Meccanica, University of Trento*, Italy. 18 June 2019.

[4] Simulation of weakly compressible flows with a Baer and Nunziato-like method: application to CO_2. *NCCS Consortium Days 2018*, Trondheim, Norway. 5–6 Dec 2018.

[5] An adaptive interpolation-free ALE scheme for inviscid flows around moving bodies. At *MOX, Politecnico di Milano*, Italy. 12 May 2017.

[6] An adaptive conservative scheme for three-dimensional Euler equations on dynamic meshes for aeronautical applications. During the course *Computational Fluid Dynamics*, prof. Quartapelle, Politecnico di Milano, Italy. 25 Jan 2016.

[7] Arbitrary Lagrangian Eulerian formulation for adaptive grids with variable connectivity. At *INRIA Bordeaux Sud-Ouest*, France. 10 Apr 2015.

5   Outreach activities

[1] B. Re, Multiphase CO2 flow: New numerical method and NCCS mobility program. Article on the *SINTEF blog*. 30/08/2019. (link).