Marc-Olivier DELCHINI

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EDUCATION

Texas A&M University, College Station, TX, USA *December 2014*
Doctor of Philosophy. Nuclear Engineering. GPA = 3.814
Dissertation: Extension of the entropy viscosity method to low-Mach fluid flows and to seven-equation two-phase flow model. Sponsored by Idaho National Laboratory (INL, RELAP-7 project).
Chair: Dr J Ragusa. Co-chair: Dr J-L Guermond. Committee members: Dr J Morel, Dr Y Hassan and Dr R Berry.

Texas A&M University, College Station, TX, USA *May 2010*
Master of Science. Nuclear Engineering. GPA = 3.681
Thesis: A preliminary study to assess model uncertainties in fluid flows.
Chair: Dr J Ragusa. Committee members: Dr J Morel, Dr V Ugaz and Dr V Mousseau.

National Polytechnic Institute of Grenoble, Grenoble, France *September 2009*
Master of Science. Energy and Nuclear Engineering.

RESEARCH INTERESTS

- Finite element analysis.
- Numerical methods.
- Computational Fluid Dynamic (CFD).
- Partial Differential Equations (PDEs).
- Single and multi-phase flows.
- Multi-physics analysis.

RESEARCH EXPERIENCE

Nuclear Engineering Department, Texas A&M University, College Station, TX, USA *2011-present*

- Developed a viscous regularization for the multi-D Euler equations with variable area using the entropy minimum principle.
- Performed a low-Mach asymptotic limit analysis to derive well-scaled viscosity coefficients.
- Performed verification tests for subsonic, transonic and supersonic single-phase flow.
- Adopted the same step-by-step process as above for the seven-equation two-phase flow model: only performed 1-D numerical tests.
- Investigated the influence of source terms (friction, wall-heat source) onto the entropy viscosity method for engineering applications.
- Extended the entropy viscosity method to a multi-physics system of equation: the 1-D grey radiation-hydrodynamic equations. Derived a viscous regularization and performed verification tests.

Idaho National Laboratory, Idaho Falls, ID, USA *Summers 2011-present*

- Implemented the numerical stabilization method for single and multi-phase flows I developed during my PhD in RELAP-7.
- Performed verification and robustness testing.
- Simulation of a 1-D Pressurized Water Reactor.

Idaho National Laboratory, Idaho Falls, ID, USA *Summer 2009*

- Worked in the Thermal Sciences & Safety Analysis Department.
- Developed a finite volume code solving the 1-D Euler equations with friction and wall-heat source terms to assess the impact of various flow models (compressible and incompressible flows, and Boussinesq approximation) for a simplified primary coolant loop of a light water nuclear reactor.
- Results showed that the incompressible and compressible models yield the same steady-state numerical solutions. The transient numerical solutions were found to behave differently under natural convection.

Nuclear Engineering Department, Madison-Wisconsin University, Madison, WI, USA *Spring 2008*

- Developed a C++ routine allowing mesh mapping between two coupled physics solved on distinct meshes in the Mesh Oriented datABase (MOAB).
- Mesh mapping was performed by conserving energy between meshes both locally (over multiple cells) and globally (over the entire mesh).
- Performed numerical tests on a single fuel pin where feedback effects between the coolant and the fuel strongly influence the heat production and other physics. This test requires to map the fuel temperature onto the mesh used for neutron calculations in order to compute the neutronic cross-sections.

JOURNAL PUBLICATIONS

M-O. Delchini, R. Ragusa, J. Morel, 'Entropy-based artificial viscosity stabilization for non-equilibrium Grey Radiation-Hydrodynamics.' Journal of Computational Physics, 2015. Vol. 293, Pages 293-313

M-O. Delchini, J. Ragusa, R. Berry, 'Entropy-based viscous regularization for the multi-D Euler equations in low-Mach and transonic flows', Computers & Fluids, 2015, Vol. 118, Pages 225-244.

M-O. Delchini, J. Ragusa, R. Berry, 'An all-Mach flow viscous regularization for seven-equation two-phase model'. (accepted)

Under review:
M-O. Delchini, J. Ragusa, R. Berry, 'Application of the reactor system code RELAP-7 to single- and two-phase flow water-hammer problems'

M-O. Delchini, J. Ragusa, 'Viscous Regularization of the non-equilibrium Grey Radiation-Hydrodynamics'

In preparation:
M-O. Delchini, J. Ragusa, R. Berry, 'Application of the entropy viscosity method to the 1-D seven-equation two-phase model'.

CONFERENCE PUBLICATIONS

M-O. Delchini, J. Ragusa, R. Berry, 'Application of the reactor system code RELAP-7 to single- and two-phase flow water-hammer problems', Joint International Conference: M&C+SNA+MC, Nashville, TN, April 19-23, 2015.

M-O. Delchini, J. Ragusa, R. Berry, 'Regularization of the non-equilibrium grey radiation hydrodynamic equations with an artificial viscosity method', Joint International Conference: M&C+SNA+MC, Nashville, TN, April 19-23, 2015

M-O. Delchini, J. Ragusa, R. Berry, 'Application of the entropy viscosity method to the 1-D seven-equation two-phase flow model', ANS Winter Meeting and Nuclear Technology Expo, Anaheim, CA, November 9-13, 2014.

M-O. Delchini, J. Ragusa, R. Berry, 'Extension of the entropy viscosity method to the low-Mach regime for the multi-dimensional Euler equations', ANS Winter Meeting and Nuclear Technology Expo, Anaheim, CA, November 9-13, 2014.

M-O. Delchini, J. Ragusa, R. Berry, 'Extension of the entropy viscosity method to flows with friction forces and source terms', PHYSOR, The role of Reactor Physic toward a Sustainable Future, The Westin Miyako, Kyoto, Japan, September 28 – October 3, 2014.

M-O. Delchini, J. Ragusa, R. Berry, 'Entropy viscosity method applied to Euler equations', International Conference on Mathematics and Computational Methods Applied to Nuclear Science & Engineering (M&C 2013), Sun Valley, Idaho, USA, May 5-9, 2013.

TECHNICAL REPORTS
(available online)

R. Berry, M-O. Delchini, J. Ragusa, 'RELAP-7 Numerical Stabilization: Entropy Viscosity Method', September 2014, INL/EXT-14-32352.

M-O. Delchini, J. Ragusa, R. Berry, 'Entropy Viscosity Method Applied to Euler Equations', September 2013, INL/CON-13-29941.

M-O. Delchini, J. Ragusa, 'A Preliminary Study to Assess Model Uncertainties in Fluid Flows', September 2009, INL_EXT_09_16995.

T. J. Tautges, A. Cacares, M-O. Delchini and D. Kaushik, 'Scalable Parallel Solution to Coupling for Multi-Physics Reactor Simulation', June 2008, GNEP-REAC-PMO-MI-DV-2008-000156.

CONFERENCE PRESENTATIONS

M-O. Delchini, J. Ragusa, R. Berry, 'Low-Mach and two-phase flow modeling with MOOSE applications', SIAM Conference on Computational Science and Engineering, Salt Lake City, Utah, March 14-18, 2015.

M-O. Delchini, J. Ragusa, R. Berry, 'Entropy-based viscous regularization for the multi-dimensional Euler equations in low-Mach regimes', PDESoft 2014 Heidelberg, July 14-16, 2014.

SKILLS AND SPECIALTIES

- C++, Fortran, MOOSE, Matlab, MCNP, Dakota, Nek5000, Star-ccm+
- Linux, Mac and Windows environments.
- Latex and Microsoft Office proficient.
- Fluent in French and English.

ACTIVITIES

- Texas A&M team handball club: player and coach.
- USA Team Handball Federation: referee.
- Texas A&M sailing club.
- Hiking and travelling.

REFERENCES

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