# TONY SAAD

CONTACT	Cony SaadCell: (801)Institute for Clean & Secure EnergyCell: (801)Che University of UtahOffice: (801)55 E 1452 S, INSCC 366E-mail: saSalt Lake City, UT 84112, USAweb: www		Cell: (801) 8 Office: (801) E-mail: saac web: www.t	10-7223 585-0344 ltony@gmail.com saad.net
OBJECTIVE	Placement in an academic faculty position.			
RESIDENCY	Permanent resident.			
RESEARCH INTERESTS	Computational & theoretical fluid dynamics, Low-Mach-number flows, Pressure projection methods, High-performance hybrid parallel computing, Analytical & asymptotic methods, Solid/Hybrid/Liquid propulsion, Simulation science, Population balances			
CAREER	Senior Computational Scientist	Institute for Clean & Secure Energy, Univ. of Utah Aug 2014 – present		
	Research Associate	Institute for Clean & Secure Energy, Univ. o	f Utah	May 2012 – Aug 2014
	Postdoctoral Fellow	Institute for Clean & Secure Energy, Univ. o	f Utah	May 2010 – May 2012
	PH.D.	University of Tennessee Space Institute, Me Engineering	echanical	May 2010
	M.E.	American University of Bierut		Oct 2005
	B.E.	Notre Dame University		Aug 2003

**RESEARCH** • Experience in large scale computational fluid dynamics (CFD) software development.

- **EXPERIENCE** Experience in object oriented and template metaprogramming using C++.
  - Experience in management of large-scale software: svn, git, regression testing, and using buildbots.
  - Experience in programming the finite volume method: structured (staggered) and unstructured grids.
  - Experience in parallel computing using MPI.
  - Experience in pressure-projection methods: Pressure poisson equation, boundary conditions.
  - Experience in analytical modeling of fluid dynamics problems using exact and asymptotic methods: perturbation, decomposition, and homotopy techniques.
  - Experience in embedded boundary methods using sharp-interface cut cells.
  - Experience in LES and its verification (Smagorinsky, WALE, Vreman).
  - Experience in order-of-accuracy verification and code validation.
  - Extensive experience (8+ years) in using Fluent to model various flow regimes and physics (multiphase, combustion, turbulence, free surface, and supersonic).
  - Experience in writing user defined functions for Fluent.

# ACADEMIC University of Tennessee Space Institute

# EXPERIENCE

- Substitute lecturer and grader for Perturbations methods 1.
- Substitute lecturer for Advanced perturbation methods.

- Substitute lecturer for Hybrid propulsion.
- Contributed to a book chapter in AIAA progress series. Fundamentals of Hybrid Rocket Combustion and Propulsion Chapter 4 "Analytical Models for Hybrid Rockets".

### **American University of Beirut**

- Teaching assistant for Solidification.
- Teaching assistant for Computational Fluid Dynamics.
- Teaching assistant for Numerical Methods.

#### **PUBLICATIONS** BOOK CHAPTERS [1]

2012 Majdalani, J., and Saad, T., (2012). Internal Flows Driven by Wall-Normal Injection, Advanced Fluid Dynamics, Prof. Hyoung Woo Oh (Ed.), ISBN: 978-953-51-0270-0, InTech, Available from: http://www.intechopen.com/books/advanced-fluid-dynamics/internal-flows-driven-by-wall-normal-injection.

#### **Refereed Articles** [12]

- 2015 **T. Saad** and J. C. Sutherland. Wasatch: an architecture-proof multiphysics development environment using a domain specific language and graph theory. *Under Review, Journal of Computational Science*, 2015
- 2015 **T. Saad**, D. Cline, J. C. Sutherland, and R. Stoll. Scalable tools for generating synthetic isotropic turbulence with arbitrary spectra. *Under Review, Journal of the Acoustical Society of America*, 2015
- 2015 A. W. Abboud, B. B. Schroeder, T. Saad, S. T. Smith, D. D. Harris, and D. O. Lignell. A numerical comparison of precipitating turbulent flows between large-eddy simulation and one-dimensional turbulence. *AIChE Journal*, 61(10):3185–3197, 2015. (doi:10.1002/aic.14870)
- 2015 T. Saad, A. W. Abboud, S. T. Smith, and T. A. Ring. A class of exact solutions for population balances with arbitrary internal coordinates. *AIChE Journal*, 61(5):1691–1698, 2015. (doi:10.1002/aic.14739)
- 2013 D. S. Crawford, T. Saad, and T. A. Ring. Verification and validation of the maximum entropy method for reconstructing neutron flux, with mcnp5, attila-7.1. 0 and the godiva experiment. Annals of Nuclear Energy, 53:188–191, 2013
- 2012 **T. Saad** and J. Majdalani. Some thoughts on the pressure integration requirements of the navierstokes equations. *Fluid Dynamics Research*, 44(6):065508, 2012
- 2012 B. A. Maicke, T. Saad, and J. Majdalani. On the compressible hart-mcclure and sellars mean flow motions. *Physics of Fluids*, 24(9):096101, 2012
- 2009 T. Saad and J. Majdalani. On the Lagrangian Optimization of Wall-Injected Flows: From the Hart-McClure Potential to the Taylor-Culick Rotational Motion. Proceedings of the Royal Society A: Mathematical, Physical and Engineering Science, 466(2114):331–362, 2009
- 2009 **T. Saad** and J. Majdalani. Rotational flowfields in porous channels with arbitrary headwall injection. *Journal of Propulsion and Power*, 25(4):921–929, 2009
- 2008 M. Darwish, **T. Saad**, and Z. Hamdan. Parallelization of an additive multigrid solver. *Numerical Heat Transfer, Part B: Fundamentals*, 54(2):157–184, 2008
- 2007 O. C. Sams, J. Majdalani, and **T. Saad**. Mean flow approximations for solid rocket motors with tapered walls. *Journal of Propulsion and Power*, 23(2):445-456, 2007
- 2007 J. Majdalani and **T. Saad**. The Taylor-Culick profile with arbitrary headwall injection. *Physics of Fluids*, 19(9):093601-10, 2007
- 2006 **T. Saad**, O. C. Sams, IV, and J. Majdalani. Rotational flow in tapered slab rocket motors. *Physics of Fluids*, 18(10):103601, 2006

**Refereed Conference Papers** [28]

- 2015 T. Saad and J. C. Sutherland. Wasatch: Addressing multiphsyics and hardware complexity in a high-performance computing environment. In Workshop on Software Development Environments for High-Performance Computing, San Francisco, CA, USA, October 2015
- 2015 J. C. Sutherland and T. Saad. Nebo: an embedded domain-specific language for platform-agnostic pde solvers. In PACT15 Tutorial on Software Stacks for Next-Gen Production Codes, San Francisco, CA, USA, October 2015
- 2015 T. Saad, A. Bagusetty, and J. C. Sutherland. Wasatch: A CPU/GPU-Ready Multiphysics Code using a Domain Specific Language. In SIAM Conference on Computational Science and Engineering, Salt Lake City, UT, March 2015
- 2015 T. Saad, C. Earl, A. Bagusetty, M. Might, and J. C. Sutherland. Uintah/Wasatch: Addressing Multiphsyics Complexity in a High-Performance Computing Environment. In SIAM Conference on Computational Science and Engineering, Salt Lake City, UT, March 2015
- 2014 J. C. Sutherland, M. Might, C. Earl, and T. Saad. Design Paradigms to Accommodate Architectural Uncertainty in Multiphysics Applications. In SIAM Parallel Processing Conference, Portland, OR, Feb. 2014
- 2013 A. W. Abboud, **T. Saad**, J. Thornock, and S. T. Smith. Large Eddy Simulation of a Precipitate Flow With QMOM. In *AIChE Annual Meeting*, San Francisco, CA, USA, November 2013
- 2013 A. Biglari, T. Saad, and J. C. Sutherland. An Efficient and Explicit Pressure Projection Method for Reacting Flow Simulations. In 8th National US Combustion Meeting, pages 1–14, Salt Lake City, UT, May 2013
- 2013 J. Schmidt, M. Berzins, J. Thornock, T. Saad, and J. Sutherland. Large Scale Parallel Solution of Incompressible Flow Problems using Uintah and Hypre. In International Symposium on Cluster, Cloud and Grid Computing, Delft, Netherlands, May 2013
- 2013 A. Biglari, **T. Saad**, and J. C. Sutherland. A Time-Accurate Pressure Projection Method for Reacting Flows. In *SIAM Numerical Combustion Conference*, San Antonio, TX, Apr. 2013
- 2012 C. W. Earl, D. Robison, T. Saad, J. C. Sutherland, and M. Might. Automated Algorithm Construction for Large Scale Computational Physics and Reacting Flow Simulations : Software Infrastructure. In *Parallel Computational Fluid Dynamics*, Atlanta, GA, May 2012
- 2012 A. W. Abboud, S. T. Smith, T. Saad, and J. Thornock. Modeling Precipitation Reactions in Turbulent Flow with QMOM Incorporated Into LES. In AIChE Annual Meeting, Pittsburgh, PA, USA, October 2012
- 2011 A. W. Abboud, S. T. Smith, T. Saad, and T. A. Ring. A study of population balance modeling in a largeeddy simulation with carbonate precipitation. In *AIChE Annual Meeting*, Minneapolis, Minnesota, USA, October 2011
- 2011 **T. Saad**, S. T. Smith, A. W. Abboud, and T. A. Ring. On a class of analytical solutions for the population balance equation. In *AIChE Annual Meeting*, Minneapolis, Minnesota, USA, October 2011
- 2011 J. C. Sutherland and T. Saad. A Novel Computational Framework for Reactive Flow and Multiphysics Simulations. In AIChE Annual Meeting, Minneapolis, MN, Oct. 2011
- 2011 B. Maicke, T. Saad, and J. Majdalani. Coordinate independent forms of the compressible potential flow equations. In 47th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, San Diego, California, USA, July 2011
- 2011 T. Saad and J. Majdalani. Viscous flows revisited in simulated rockets with radially regressing walls. In 47th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, San Diego, California, USA, July 2011
- 2011 **T. Saad** and J. Majdalani. Some thoughts on Kelvin's minimum energy theorem. In *International Conference on Advanced Research and Applications in Mechanical Engineering*, 2011

- 2011 J. C. Sutherland and T. Saad. The Discrete Operator Approach to the Numerical Solution of Partial Differential Equations. In 20th AIAA Computational Fluid Dynamics Conference, pages AIAA–2011– 3377, Honolulu, Hawaii, USA, June 2011
- 2011 D. Robinson, N. Punati, **T. Saad**, and J. C. Sutherland. A novel computational approach for multiphysics and reactive flow simulations. In *Proceedings of the Combustion Institute*, 2011
- 2010 B. Maicke, **T. Saad**, and J. Majdalani. On the compressible irrotational taylor flow in porous channels. In *40th AIAA Fluid Dynamics Conference and Exhibit*, Chicago, Illinois, USA, June 2010
- 2010 **T. Saad** and J. Majdalani. Pressure integration rules and restrictions for the navier-stokes equations. In *40th AIAA Fluid Dynamics Conference and Exhibit*, Chicago, Illinois, USA, June 2010
- 2010 **T. Saad** and J. Majdalani. Extension of kelvin's minimum energy theorem to flows with open regions. In *40th AIAA Fluid Dynamics Conference and Exhibit*, Chicago, Illinois, USA, June 2010
- 2009 T. Saad and J. Majdalani. Energy based solutions of the bidirectional vortex with multiple mantles. In 45th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, (AIAA Paper 2009-5305), Denver, Colorado, Aug. 2009
- 2009 T. Saad and M. Darwish. A high scalability parallel algebraic multigrid solver. In Computational Fluid Dynamics 2006, pages 231–236. Springer, 2009
- 2008 **T. Saad** and J. Majdalani. Energy based solutions of the bidirectional vortex. In 44th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, (AIAA Paper 2008-4832), Hartford, Connecticut, July 2008
- 2008 **T. Saad** and J. Majdalani. Energy based mean flow solutions for slab hybrid rocket chambers. In 44th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, (AIAA Paper 2008-5021), Hartford, Connecticut, July 2008
- 2007 **T. Saad** and J. Majdalani. The Taylor profile in porous channels with arbitrary headwall injection. In *37th AIAA Fluid Dynamics Conference and Exhibit*, volume 2007-4120 of *(AIAA Paper 2007-4120)*, Miami, Florida, 2007
- 2007 J. Majdalani and **T. Saad**. Energy steepened states of the Taylor-Culick profile. In 43rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, (AIAA Paper 2007-5797), Cincinnati, Ohio, July 2007
- 2006 M. Darwish and T. Saad. A high scalability parallel algebraic multigrid solver. In European Conference on Computational Fluid Dynamics, pages 231–236, Egmond aan Zee, The Netherlands, September 2006
- 2006 **T. Saad** and M. Darwish. A high scalability parallel algebraic multigrid solver. In 4th ICCFD Conference, Ghent, Belgium, July 2006
- 2005 **T. Saad**. Implementation and performance analysis of a parallel algebraic multigrid solver. In 4th *FEA Student Conference at the American University of Beirut*, Riad El Solh, Lebanon, May 2005
- COMPUTERC, C++, templated C++ metaprogramming, VISIT, Message Passing Interface (MPI),SKILLSHTML/CSS/Web Design, LaTeX, Fluent, Mathematica, Matlab.

#### SERVICE

- Co-PI on SBIR submitted with Reaction Engineering International, SLC, UT.
- Reviewer for: Combustion Theory and Modelling, Flow Turbulence and Combustion, International Journal of Energetic Materials and Chemical Propulsion.
- Helped review proposals.
- Judged AIAA student conference papers.
- Chaired graduate technical sessions in AIAA student conference.
- CFD-Online Wiki: Administrator and author (http://www.cfd-online.com/Wiki).
- PMAN: Founder and author online science journal (http://pman.tsaad.net).
- Show Me the Math: Founder and author online repository of numerics-related mathematical proofs and derivations (http://www.tsaad.net/showmethemath/).

#### AWARDS

- NSF IREE research internship Peking University, 2008.
- "Outstanding Graduate Research Assistant" award University of Tennessee Space Institute, 2007.
- Crawford Lloyd Fellowship University of Tennessee Space Institute, 2005 & 2007.
- Graduate Research Assistantship University of Tennessee Space Institute, 2005 2010.
- Graduate Research Assistantship American University of Beirut, 2003-2005.
- Dean's List American University of Beirut, all semesters.
- "Abd el Aal Litani River Award", 2003.
- Exemption from tuition fees Notre Dame University, spring 2003.
- Scholarship: 25-50% Scholarship Notre Dame University, all semesters.
- Dean's List Notre Dame University, all semesters.
- LANGUAGES Fluent in English, French, and Arabic.

# **REFERENCES** Prof. James C. Sutherland Associate Professor

Chemical Engineering University of Utah Salt Lake City, UT, 84112 Office: (801) 585-1246 james.sutherland@utah.edu

# Dr. Brian Maicke

Assistant Professor Mechanical Engineering Penn State University, Harrisburg Middletown, PA, 17057 Office: (717) 948-6662 bam49@psu.edu

# Prof. Terry A. Ring

Professor Chemical Engineering University of Utah Salt Lake City, UT, 84112 Office: (801) 585-5705 ring@eng.utah.edu

# Prof. Joseph Majdalani

Professor and Department Chair Aerospace Engineering Auburn University Auburn, AL, 36849 Office: (334) 844-6800 joe.majdalani@auburn.edu

# Dr. Sean T. Smith

Assistant Research Professor Chemical Engineering University of Utah Salt Lake City, UT, 84112 Office: (801) 585-1002 sean.t.smith@utah.edu

# Prof. Michel el Hayek

Professor and Dean Mechanical Engineering Notre Dame University Zouk Mosbeh, Lebanon Office: (961) 9-218-950 – Ext: 2032 mhayek@ndu.edu.lb