

# William Frederick Louisos, PhD ME

School of Engineering – The University of Vermont

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## EDUCATION

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Ph.D. in Mechanical Engineering, The University of Vermont, Burlington, VT *July 2009*  
Ph.D. Dissertation: “Numerical Studies of Viscous Flow in Supersonic MicroNozzles”

M.S. in Mechanical Engineering, The University of Vermont, Burlington, VT  
M.S. Thesis: “Viscous Effects in 2D Supersonic MicroNozzle Flow” *May 2005*

B.S. *Cum Laude* in Mechanical Engineering, School of Engineering & Applied Sciences  
State University of New York at Buffalo, Buffalo, NY *May 2003*

## RESEARCH EXPERIENCE

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### Supersonic MicroNozzles / Micropropulsion

Numerical simulations of viscous, supersonic flows in a Micro-Electro-Mechanical-Systems (MEMS) based converging-diverging supersonic thruster nozzles. The micro-thruster will be used for station keeping in the next generation of small scale satellites, i.e., nanosatellites, as they fly in distributed networks. The supersonic micronozzle is a key component in the micropropulsion system

### Chaotic Natural Convection in a Thermosyphon / Toy Climate

Computational studies investigating the nonlinear dynamics of natural convection in 2D and 3D thermosyphon convection loops. The thermosyphon is employed to simulate a toy climate and flow regimes are characterized as stable or chaotic in terms of the Rayleigh number.

### Spacecraft Thermal Protection Systems

Support the development of a porous media based numerical model for characterization of ablation in carbon-phenolic thermal protection systems for atmospheric reentry of spacecraft.

### Blood Flow & Damage in Medical Devices

FDA's Critical Path Project to Validate CFD Methods Used in Medical Device Evaluation – A collaborative research project aimed to determine how computational fluid dynamics can be effectively used to characterize blood flow and predict blood-cell damage in medical devices.

## INDUSTRY EXPERIENCE

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### Trane Energy Systems of Buffalo, New York

*May 2001 – August 2003*

Mechanical Engineer & CAD Specialist

- Distributed power generation and Cogeneration systems.
- Refrigeration, heat recovery, and thermal storage systems.
- Building automation, control, and energy management.
- Engine, fuel cell, and microturbine power generation.
- HVAC, hydronic, natural gas, steam, and electrical systems.
- Computer Network design and installation – multiple servers and remote hubs.

## PROFESSIONAL ACHIEVEMENTS, AFFILIATIONS, HONORS, AWARDS

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- CEMS Faculty Award for Excellence in Service – 2017
- *Nominee*: Kroepsch-Maurice Teaching Award – UVM – 2014, 2015, 2017, 2018, 2019
- College of Engineering & Mathematical Sciences Outstanding Teacher of the Year - 2014
- AIAA Senior Member – *American Institute of Aeronautics & Astronautics*
- ASEE Member – *American Society for Engineering Education*
- Tau-Beta-Pi – *National Engineering Collegiate Honor Society*
- Phi-Eta-Sigma – *National Collegiate Honor Society*
- Graduate Student Award in ME 2008 – 2009 – *The University of Vermont*
- Graduate Student Award 2005 – 2006 – *The University of Vermont*
- Graduate Student Award 2004 – 2005 – *The University of Vermont*
- Robert B Kleinschmidt Memorial Award – *University at Buffalo*

## CONSULTING WORK

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- Benchmark Space Systems *Summer 2018 - Present*
- Calculated Technologies - Passive Heat Transfer via Optical Means *Fall 17 - Spring 18*
- HVAC Thermal Destratification CFD simulations *Spring 2009*
- Avatar Energy – Flow modeling of cattle manure methane digester *Spring 2006*
- iTec – Flow modeling of an on demand hot water heater *Spring 2005*
- CTX – Modeling of Rarefied gas heat transfer in a space craft *Fall 2004*

## PEER REVIEWED JOURNAL ARTICLES

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- **Louisos, W.F.** & Hitt, D.L., “Assessing the potential for Condensation in Supersonic MicroNozzle Flows” *AIAA Journal of Spacecraft & Rockets*  
– *In Final Preparation.*
- Greenfield, Ben., **Louisos, W.F.**, & Hitt, D.L., “Impact of Dilute Multiphase Flow in Supersonic Micronozzles” *AIAA Journal of Spacecraft & Rockets*, Vol. 56, No. 1, pp. 190-199, 2019
- Pearl, J., **Louisos, W.F.**, Hitt, D.L., “Thrust Calculation for Low-Reynolds-Number Micronozzles” *AIAA Journal of Spacecraft & Rockets*, Vol. 54, No. 1, pp. 287-298, 2017
- **Louisos, W.F.**, Hitt, D.L., & Danforth, C.M. “Chaotic Natural Convection in a Toroidal Thermosyphon with Heat Flux Boundaries” *International Journal of Heat & Mass Transfer*, Vol. 88, pp. 492-507, September 2015.
- **Louisos, W.F.** & Hitt, D.L., “Numerical Studies of Supersonic Flow in Bell-Shaped MicroNozzles” *AIAA Journal of Spacecraft & Rockets*, Vol. 51, No. 2, pp. 491-500, 2014.
- Sandy F. C. Stewart, Prasanna Hariharan, Eric G. Paterson, *et al.* “Results of FDA’s First Interlaboratory Computational Study of a Nozzle with a Sudden Contraction and Conical

Diffuser.” Journal of Cardiovascular Engineering and Technology, Sept. 2013. – *CFD Contributing Participant*.

- **Louisos, W.F.**, Hitt, D.L., & Danforth, C.M. “Chaotic flow in a 2D natural convection loop with heat flux boundaries” International Journal of Heat & Mass Transfer, Vol. 61, pp. 565-576, June 2013.
- Sandy F. C. Stewart, Eric G. Paterson, Greg W. Burgreen, Prasanna Hariharan, *et al.* “Assessment of CFD Performance in Simulations of an Idealized Medical Device: Results of FDA’s First Computational Interlaboratory Study” Journal of Cardiovascular Engineering & Technology, February, 2012 – *CFD Contributing Participant*.
- **Louisos, W.F.** & Hitt, D.L., “Influence of Wall Heat Transfer on Supersonic MicroNozzle Performance” AIAA Journal of Spacecraft & Rockets, Vol. 49, No. 3, pp. 450-460, 2012.
- **Louisos, W.F.** & Hitt, D.L., “Viscous Effects on Performance of Three-Dimensional Supersonic Micronozzles” AIAA Journal of Spacecraft & Rockets, Vol. 49, No. 1, pp. 51-58, 2012.
- **Louisos, W.F.** & Hitt, D.L., “Analysis of Transient Flow in Supersonic Micronozzles” AIAA Journal of Spacecraft & Rockets, Vol. 48, No. 2, pp. 303-311, 2011.
- **Louisos, W.F.** & Hitt, D.L., “Viscous Effects on Performance of Two-Dimensional Supersonic Linear Micronozzles” AIAA Journal of Spacecraft & Rockets, Vol. 45, No. 4, pp. 706-715, 2008.
- **Louisos, W.F.**, Alexeenko, A.A., Hitt, D.L. & Zilic, A, “Design Considerations for Supersonic Micronozzles” International Journal of Manufacturing Research, Vol. 3, No. 1, pp. 80-113, 2008.

#### PEER REVIEWED BOOK CHAPTERS

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- **Louisos, W.F.** & Hitt, D.L., “Supersonic Micro-Nozzles” Encyclopedia of Microfluidics and NanoFluidics, Springer Publishers, 2008

#### PEER REVIEWED CONFERENCE PROCEEDINGS

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- Pearl, J., Hitt, D.L., **Louisos, W.F.**, “Curvilinear Surface-Based Gravity Model for Evolutionary Trajectory Optimization around Bennu” 29th AAS/AIAA Space Flight Mechanics Meeting, Ka’anapali, Hawaii, Paper ID AAS 19-339, January 13-17, 2019.
- Pearl, J., Hitt, D.L., **Louisos, W.F.**, “Hybrid Gravity Model for Asteroids with Heterogeneous Density Distributions” AIAA Space Flight Mechanics Meeting, AIAA Science and Technology Forum 2018, AIAA-2018-0955, Kissimee, Florida, January 8-12, 2018.

- Pearl, J., **Louisos, W.F.**, Hitt, D.L., “Three-Dimensional Numerical Study of Linear Plug Micronozzles” Proc. of 53rd AIAA Aerospace Sciences Meeting, AIAA Science and Technology Forum 2015, Control ID#: 2020655, Kissimee, Florida, January 5-9, 2015.
- Pearl, J., **Louisos, W.F.**, Hitt, D.L., “Viscous Effects on Performance of Linear Plug Micronozzles.” Proc. of ASME 2014 International Mechanical Engineering Congress & Exposition, IMECE2014-37612, Nov. 14-20, 2014, Montreal Quebec, Canada
- **Louisos, W.F.**, Hitt, D.L., & Danforth, C.M. “Chaotic Natural Convection in a Toroidal Thermosyphon with Heat Flux Boundaries” Proc. 44<sup>th</sup> AIAA Thermophysics Conference, San Diego, California. June 23-27, 2013. Paper No. AIAA-2013-2638
- **Louisos, W.F.**, Hitt, D.L., & Danforth, C.M. “Chaotic Flow in a 2D Natural Convection Loop with Heat Flux Boundaries” Proc. 43rd AIAA Thermophysics Conference, New Orleans, Louisiana. June 25-28, 2012. Paper No. AIAA-2012-2752
- **Louisos, W.F.** & Hitt, D.L., “Transient Analysis of Supersonic Viscous Flow in 3D MicroNozzles” Proc. 41<sup>st</sup> AIAA Fluid Dynamics Conference, Honolulu, Hawaii. June 27-30, 2011. Paper No. 2011-3996
- Greenfield, B., **Louisos, W.F.**, Hitt, D.L., “Numerical Simulations Of Multiphase Flow In Supersonic Micro-Nozzles” Proc. 49th AIAA Aerospace Sciences Meeting, Orlando, Florida. January 4-7, 2011.
- **Louisos, W.F.** & Hitt, D.L., “Transient Simulations of 3D Supersonic MicroNozzle Flows” Proc. 8th International Conference on Nanochannels, Microchannels, and Minichannels, Montreal, Canada August 1-5, 2010. Paper No. FEDSM-ICNMM2010-30968
- **Louisos, W.F.** & Hitt, D.L., “Assessing the potential for Condensation in Supersonic MicroNozzle Flows” Proc. 10<sup>th</sup> AIAA/ASME Joint Thermophysics & Heat Transfer Conference, Chicago, Illinois, June 28 – July 1, 2010. Paper No. 2010-5059.
- **Louisos, W.F.** & Hitt, D.L., “The Role of Heat Transfer on Performance of 3D Supersonic Micronozzles” Proc. 39<sup>th</sup> AIAA Fluid Dynamics Conference, San Antonio, Texas, June 22-25, 2009. Paper No. 2009-3823.
- **Louisos, W.F.** & Hitt, D.L. “Numerical Simulations of Viscous Flow in 3D Supersonic Bell Micronozzles” Proc. 47<sup>th</sup> AIAA Aerospace Sciences Meeting, Orlando, Florida. Jan. 5-8, 2009. Paper No. 2009-446.
- **Louisos, W.F.**, Hitt, D.L., Alexeenko, A.A., & Ketsdever, A, “Operating Characteristics of Micro-Scale Supersonic Nozzles: An Overview” Proc. Advanced Space Propulsion Workshop, Pasadena, California October 28-30, 2008.
- **Louisos, W.F.** & Hitt, D.L. “Numerical Studies of Thrust Production in 2-D Supersonic Bell Micronozzles” Proc. 44<sup>th</sup> AIAA Joint Propulsion Conference., Hartford, Connecticut July 20-23, 2008. Paper No. 2008-5233.

- **Louisos, W.F. & Hitt, D.L.** “Performance Characteristics of 3D Supersonic Micronozzle Flows” Proc. 38<sup>th</sup> AIAA Fluid Dynamics Conference, Seattle, Washington June 23-26, 2008. Paper No. 2008-4279.
- **Louisos, W.F. & Hitt, D.L.** “Heat Transfer & Viscous Effects in 2D & 3D Supersonic Micro-Nozzle Flows” Proc. 37<sup>th</sup> AIAA Fluid Dynamics Conference, Miami, Florida June 25-28, 2007. Paper No. 2007-3987.
- **Louisos, W.F. & Hitt, D.L.**, “Viscous Effects in Supersonic Micro-Nozzle Flows: Transient Analysis,” Proc. 36<sup>th</sup> AIAA Fluid Dynamics Conference, June 5-8 2006, San Francisco, California. Paper No. AIAA-2006-2874.
- **Louisos, W.F. & Hitt, D.L.**, “Optimal Expander Angle for Viscous Supersonic Flow in 2-D Micro-Nozzles,” Proc. 35<sup>th</sup> AIAA Fluid Dynamics Conference, June 6-9 2005, Toronto, Canada. Paper No. AIAA-2005-5032.

#### REFEREED CONFERENCE ABSTRACTS

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- Mancu, S., Dubief, Y., **Louisos, W.**, Harris, T., & Hitt, D. “Numerical Simulation of Slug Formation in Micro-Channels” Proceedings of the 60<sup>th</sup> American Physical Society DFD Nov. 18-20, 2007. Salt Lake City, Utah.
- **Louisos, W.F. & Hitt, D.L.**, “Viscous Effects in Supersonic Micro-Nozzle Flow” Proceedings of the 59<sup>th</sup> American Physical Society DFD Nov. 19-23, 2006. Tampa, Florida.

#### REVIEWER

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| • AIAA Journal of Spacecraft and Rockets (1)             | <i>Fall 2021</i>         |
| • AIAA Journal of Propulsion and Power (1)               | <i>Fall 2020</i>         |
| • International Journal of Heat & Mass Transfer (1)      | <i>Spring 2019</i>       |
| • Acta Astronautica (1)                                  | <i>Fall 2018</i>         |
| • International J. of Heat & Mass Transfer (1)           | <i>Spring 2018</i>       |
| • Journal of Spacecraft & Rockets (1)                    | <i>Spring 2018</i>       |
| • International Journal of Heat & Mass Transfer (1)      | <i>Fall 2017</i>         |
| • Journal of Non-Linear Dynamics (1)                     | <i>Fall 2017</i>         |
| • Journal of Advances in Space Research (2)              | <i>Spring 2017</i>       |
| • Journal of Microsystem Technologies (1)                | <i>Fall 2016</i>         |
| • Journal of Applied Ocean Research (1)                  | <i>Fall 2016</i>         |
| • Journal of Engineering and Computational Mechanics (1) | <i>Summer 2015</i>       |
| • IEEE Transactions on Control Systems Technology (1)    | <i>Fall 2014</i>         |
| • American Society of Engineering Education (6)          | <i>Spring 2014</i>       |
| • International J. of Heat & Mass Transfer (1)           | <i>Spring 2014</i>       |
| • AIAA Science & Technology Forum & Exposition (8)       | <i>Summer 2013</i>       |
| • International J. of Heat & Mass Transfer (3)           | <i>Summer, Fall 2013</i> |
| • Journal of Mechanical Engineering Science (1)          | <i>Spring 2013</i>       |
| • Journal of Micro-Mechanics & Micro-Engineering (2)     | <i>Spring 2013</i>       |

- AIAA Fluid Dynamics Conference, San Diego, CA (4) *Spring 2013*
- AIAA Fluid Dynamics Conference, New Orleans, LA (8) *Spring 2012*
- Journal of Aircraft Engineering and Aerospace Technology (1) *Spring 2011*
- Acta Astronautica (1) *Fall 2010*
- Textbook: Thermodynamics by Robert Balmer, Elsevier Publishing *Fall 2010*
- AIAA Journal of Propulsion & Power (1) *Fall 2010*
- Journal of MicroMechanics and MicroEngineering (1) *Fall 2010*
- ASME Conf. on Nano-, Micro-, and Mini-channels, Montreal (4) *Summer 2010*
- AIAA Fluids Dynamics Conference, Chicago, IL (10) *Spring 2010*
- Book review of McGraw-Hill Nano/Microscale Heat Transfer (1) *Spring 2006*

#### SERVICE TO THE UNIVERSITY OF VERMONT

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- Tau-Beta-Pi Chief Faculty Advisor *Fall 2021 – Present*
- UVM NASA RockSat Team – Adviser *Spring 2020 - 2021*
- UVM Fulbright Award Review Committee *Fall 2019*
- AIAA Student Club – Faculty Adviser *Fall 2019 - Present*
- Diversity Curriculum Review Committee *Fall 2013 – Spring 2016*
- Faculty Senate: Student Affairs Committee *Fall 2013 – Spring 2021*
- UVM Men’s Lacrosse Team – Faculty Advisor *Spring 2013 – Fall 2015*
- CEMS / School of Engineering Curriculum Committee *Fall 2012 – 2014*
- UVM Alternative Energy Racing Organization (AERO) Team  
– Interim Faculty Advisor *Fall 2012*
- CEMS / School of Engineering Studies Committee *Fall 2011 – 2015, Fall 2021*
- UVM Mini-Baja Team – Faculty Advisor *Fall 2010 – Fall 2016*
- UVM CATWatch Coordinator *Fall 2010 – 2019*
- Vermont in Person Student Visitation Days (4-6 days per semester) *Fall 2010 - 2014*
- FE Exam Review Sessions – Thermodynamics *Fall/Spring 2009 – 2012, 2014*

#### PROFESSIONAL SERVICE

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- Vermont Space Grant – GRA Scholarship Reviewer *Spring 2016 - 2019*
- Vermont Space Grant – Ugrad Scholarship Reviewer *Spring 2013 - 2020*
- Session Chair, AIAA Fluid Dynamics Conference, San Diego (2 sessions) *Summer 2013*
- Session Chair, AIAA Fluid Dynamics Conference, New Orleans, LA (2 sessions) *Summer 2012*
- Session Chair, AIAA Fluid Dynamics Conference, Chicago, IL (1 session) *Summer 2010*

## COMMUNITY SERVICE

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- MLK Service Day - Lucy's House for the Prevention of Homeless Pets *January 15, 2018*
- Governor's Institute of Vermont (GIV) – Guest Speaker & Laboratory Demo *Summer 2016*
- Connecticut River Watershed Council's 18th annual Source to Sea Cleanup *Fall 2014*
- Oak Street Boys & Girls Club and Sara Holbrook Center - Guest Speaker *Spring 2013*
- Science Fair Judge for Milton, Vermont Public Schools *Spring 2012*
- Science Fair Judge for Milton, Vermont Public Schools *Spring 2011*

## SUMMARY OF FUNDING

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### **2014 - 2016**

Project Title: "Enhancement of the Aviation Technology Program at Burlington Technical Center."

Source: NASA Office of Education

Program: Competitive Opportunity for Partnerships with Community Colleges and Technical Schools

Role: Co-Investigator (PI Darren Hitt)

Amount: \$440,662

Project duration: 09/01/14 – 8/31/16

Time commitment: 1 month per summer at 100% effort

### **2015 - 2016**

Project Title: "Investigations of MicroNozzles with Aerospike / Plug Geometries for Small Satellite Propulsion & Control"

Source: Vermont Space Grant

Program: Graduate Fellowship

Role: Primary Investigator

Amount: \$27,500

Project duration: 07/01/14 – 5/17/15

Time commitment: PhD Student Adviser

### **2016 - 2017**

Project Title: "Transient Analysis of the Conjugate Heat Transfer in Supersonic Micronozzles with Aerospike Geometries for Small Satellite Propulsion and Control"

Source: Vermont Space Grant

Program: Graduate Fellowship

Role: Primary Investigator

Amount: \$27,500

Project duration: 07/01/16 – 5/17/17

Time commitment: PhD Student Adviser

**2017 - 2018**

Project Title: "Hybrid Gravity Model for Asteroids with Heterogeneous Density Distributions"

Source: Vermont Space Grant

Program: Graduate Fellowship

Role: Primary Investigator

Amount: \$27,500

Project duration: 07/01/17 – 5/17/18

Time commitment: PhD Student Adviser

**2018 - 2019**

Project Title: "High Order Numerical Schemes for the Simulation of Irregular Gravity Fields"

Source: Vermont Space Grant

Program: Graduate Fellowship

Role: Primary Investigator

Amount: \$27,500

Project duration: 07/01/18 – 5/17/19

Time commitment: PhD Student Adviser

**2019 - 2020**

Project Title: "Development of a Micropropulsion Fuel Delivery System for Hypergolic Bipropellents."

Source: Vermont Space Grant

Program: Graduate Fellowship

Role: Primary Investigator

Amount: \$27,500

Project duration: 07/01/19 – 5/17/20

Time commitment: MS Student Adviser

**2022 - 2023**

Project Title: "Overpressurization and Surface Contamination in Small-Satellite Propulsion On-Demand-Pressurization-Systems."

Source: Vermont Space Grant

Program: Graduate Fellowship

Role: Primary Investigator

Amount: \$32,000

Project duration: 07/01/22 – 6/30/23

Time commitment: MS Student Adviser