Temistocle Grenga

CONTACT INFORMATION

Institute for Combustion Technology (ITV) *Voice:* +[redacted]

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RESEARCH INTERESTS

Computational Fluid Dynamics: turbulent compressible reacting flows, multiphase flows, direct numerical simulations, large eddy simulations, adaptive mesh refinement methods, wavelet methods, numerical methods, parallel programming, high performance computing
Combustion: model reduction, analysis and solution of large chemical kinetic mechanisms in view of CFD applications, development of stiff solvers for dissipative systems
Machine Learning: turbulence and combustion closure modeling through Generative Adversarial Network, Convolutional Neural Network, and Gene Expression Programming
Data Driven Modeling: Dynamic Mode Decomposition, Principal Component Analysis

ACADEMIC APPOINTMENTS

Rheinisch-Westfälische Technische Hochschule Aachen, Aachen, Germany
Postdoctoral Research Associate (Senior level: TV-L14) **September 2018 - present**
Conducting research in the Institute of Combustion Technology (ITV) directed by Prof. H. Pitsch.
Leader of the ITV Multiphase group.

Princeton University, Princeton, New Jersey USA
Postdoctoral Research Associate **October 2015 - August 2018**
Conducting research in the Computational Turbulent Reacting Flow Laboratory directed by Prof. M. E. Mueller.

NON-ACADEMIC APPOINTMENTS

Ecotech GmbH
Consultant **November 2019 - December 2020**
Conducting numerical simulations for optimization of burners for domestic application.

EDUCATION

University of Notre Dame, Notre Dame, Indiana USA

Ph.D., Aerospace and Mechanical Engineering, September 2015

- Dissertation Topic: "Numerical simulation of multi-dimensional compressible reactive flow using a parallel wavelet adaptive multi-resolution method"
- Advisor: Prof. S. Paolucci

University of Notre Dame, Notre Dame, Indiana USA

M.S., Mechanical Engineering, August 2013

- Dissertation Topic: "Numerical simulation of multi-dimensional compressible reactive flow using a parallel wavelet adaptive multi-resolution method"
- Advisor: Prof. S. Paolucci

Sapienza University of Rome, Rome, Italy

M.S., Aeronautical Engineering, July 2009

- Dissertation Topic: "Model reduction and analysis for the combustion of hydrocarbon fuels"
- Advisor: Prof. M. Valorani

Sapienza University of Rome, Rome, Italy

B.S., Aerospace Engineering, July 2005

- Dissertation Topic: "Modeling and analysis of turbojet engine performances"

- Advisor: Prof. F. Nasuti

VISITING PERIODS

Los Alamos National Laboratory, Los Alamos, New Mexico USA
Visiting researcher **October - December 2014**
Investigation of the Richtmyer-Meshkov instability (RMI) using Wavelet Adaptive Multi-resolution Representation (WAMR) method.

Center for Research in Extreme Scale Technologies (CREST), Indiana University, Bloomington, Indiana USA
Visiting researcher **June 2014**
Implementation of the parallel solver for partial differential equations, Wavelet Adaptive Multi-resolution Representation (WAMR), in HPX-5

TEACHING EXPERIENCE

Rheinisch-Westfälische Technische Hochschule Aachen, Aachen, Germany
Lecturer **October, 2019 - present**
Multiphase Flows course for the Master Degree in Mechanical Engineering, Computational Engineering Science, Energy Engineering and Simulation Science.

Rheinisch-Westfälische Technische Hochschule Aachen, Aachen, Germany
Advisor **June, 2019 - present**
Ph. D. students supervision (as Leader of Multiphase Flows Group at ITV):

- A. Y. D., November 2021, Project: *Physics-based reduced-order modeling of fuel injection and combustion processes in internal combustion engines*
- H. C., expected 2022, Project: *Investigation and modeling of the early flame spread in gasoline engine.* This project is part of the graduate program *Integrated Energy Supply Modules for Roadbound E-Mobility" (mobilEM)* at RWTH Aachen University funded by DFG.
- F. F., expected 2024, Project: *Influence of atomization on particle synthesis in spray flames*
- A. S., expected 2024, Project: *Modeling of flash-boiling effect of spray in gasoline engine*
- L. N., expected 2025, Project: *Turbulent reacting flow modeling through generative adversarial network*
- M. V., expected 2026, Project: *Hybrid implicit/explicit approach for massively parallelizes ODE integration*

Master thesis students:

- P. H., expected November 2022, *Laminar flame speed models for premixed flames using Gene-Expression Programming*
- B. C., expected March 2022, Project: *Reduced order model for soot through Principal Component Analysis*
- C. D. K. S., June 2021, Project: *Development of a super-resolution generative adversarial network with physics-based loss function in the context of turbulent reacting flows*
- A. N. K., March 2021, Project: *Data-driven model for turbulent flows using machine learning*
- S. B., April 2020, Project: *Deep learning driven computing in computational mechanics*
- M. P. (University of Bologna), September 2019, Project: *Wavelet analysis of downslope flows in Materhorn 2012 experiment*

National center for Supercomputing Application Bulgaria
Lecturer at South-East Erope Combustioon Spring School 2022 **March, 2022**
Course on Machine Learning based methodologies for combustion

University of Notre Dame, Notre Dame, Indiana USA
Lecturer at Notre Dame Summer Scholars program **August, 2015**

Research Computing: Computers Accelerating Discovery
(http://precollege.nd.edu/summer-scholars/research-computing/)

University of Notre Dame, Notre Dame, Indiana USA
Teacher Assistant **August, 2009 - May 2015**
Duties at various times have included office hours, teaching computational exercises, leading weekly practice exercises, leading weekly experimental lab, homework assignments, and grading for the graduate courses in Continuum Mechanics, Numerical Methods, and Mathematical Methods as well as undergraduate courses in Heat Transfer, Molecular Thermodynamics, and Introduction to Mechanical Engineering.

University of Notre Dame, Notre Dame, Indiana USA
Lecturer at Notre Dame Summer Scholars program **August, 2014**
Research Computing: Computers Accelerating Discovery
(http://precollege.nd.edu/summer-scholars/research-computing/)

University of Notre Dame, Notre Dame, Indiana USA
Advisor for Undergraduate Research **Spring semester, 2014**
Verification of the Wavelet Adaptive Multi-resolution Representation method to a prescribed error threshold

Research and Professional Experience

Leading and coordinating the research activities involved in Work Package 4 (development of numerical methodologies for discretization, grid management, reduced thermo-physical-chemical models) and Tasks 7.1 (DNS of complex multi-physics processes) and 7.4 (machine learning techniques for turbulence-chemistry interaction) on behalf of the WP/task leader (Prof. Pitsch, ITV) in the *Center of Excellence of Combustion (CoEC)* (https://coec-project.eu/). This is a European Horizon2020 project (October 2020 - September 2023) for the collective development of in-house codes for turbulent reacting flows ready for coming exascale computing systems.

Leading the activities of HPC group at ITV (May 2019 - ongoing) : supervision and coordination of applications for computing time and data storage at European and national facilities; coordinating the development of in-house codes; research data managing organization; realization and managing of regression tests platform for in-house codes, maintenance of ITV cluster.

Supervision of the ITV research activities (in the role of Group Leader at ITV) for the following projects:

- Development of in-house libraries for combustion models and particle transport for the German national project *National High-Performance Computing for Computational Engineering Science (NHR4CES)* (https://www.nhr4ces.de/) for the efficient use of Tier-2 HPC systems (January 2021 - ongoing).
- Simulation and characterization of the physical phenomena, such as break-up, atomization, combustion, particle nucleation and growth, occurring during the flame synthesis of nanoparticles for the project*Influence of atomization on particle synthesis in spray flames* (DFG Priority Program SPP1980 Nanoparticle Synthesis in Spray Flames SpraySyn: Measurement, Simulation, Processes) (https://www.uni-due.de/spp1980/) (February 2019 - ongoing).
- Numerical modeling, simulation and characterization of flash boiling and cavitation phenomena and their effects on spray features in gasoline engines, and realization and development of a reduced-order model (cross-sectionally averaged) for transient turbulent reactive sprays in compression ignition engines for the project *High-fidelity numerical simulations and model development for fuel injection in advanced combustion systems* in the Fuel Science Center (Cluster of Excellence)
(https://www.fuelcenter.rwth-aachen.de/cms/ siul/Fuelcenter/?lidx=1) (January 2019 - ongoing).
- Realization of an ANN-based predictive combustion model for direct-injected CNG engines to assess NO_x and UHC emissions for the project *Combustion simulation modeling of CNG*

engines (Ford - RWTH Alliance) (April 2019 - March 2021).

Collaboration with Prof. R. Sandberg of University of Melbourne (April 2020 - ongoing) on the realization of turbulence and combustion closure models through the use of Gene Expression Programming. This activity is integrated in the framework of the joint PhD program between RWTH Aachen University and the University of Melbourne.

Collaboration with Prof. A. Attili of University of Edinburgh (April 2020 - ongoing) on the realization of turbulence and combustion closure models through the use of Convolutional Neural Network.

Collaboration with Prof. A. Cuoci of Polytechnic University of Milan (March 2021 - ongoing) on the use of Principal Component Analysis-based Cell Agglomeration for CFD simulations with detailed kinetic mechanisms.

Realization of parallel in-house code for Dynamic Mode Decomposition and application to massive DNS databases of turbulent reacting flows (October 2015 - August 2018)

Collaboration with the *Center for Shock Wave-processing of Advanced Reactive Material (C-SWARM)*, University of Notre Dame, for the development of the Wavelet Adaptive Multiresolution Representation method in both MPI and HPX versions (October 2015 to May 2017).

Realization of in-house time-adaptive solver for stiff ODE systems, and creation of a chemical reduction tool (G-Scheme) (September 2009 - September 2015).

Research Grants

Jülich Supercomputing Centre (JSC) Computing Project, **PI for the project** "Influence of physically-inspired losses on Super-Resolution Generative Adversarial Network for turbulent flows" March-September 2021

Jülich Supercomputing Centre (JSC) Data Storage Projects, **PI for the projects** "CoEC Database of Turbulent Reacting flow", April 2021 - April 2023, "DNS Database of Turbulent Combustion", April 2021 - April 2023, "DNS database for Multiphysics Modeling of Combustion", May 2021 - April 2023

RWTH Computing Project (CLAIX18), **PI for the projects** "Detailed simulations of the nozzle-dependent primary atomization of the SpraySyn burner", December 2021 - November 2022; "Direct Numerical Simulation setup for a turbulent solid pulverized fuel flame", June 2021 - May 2022; "Understanding the effects of the strong scaling approach on 3D super-resolution Generative Adversarial Networks with turbulent flows", March 2021 - February 2022; "Setup of Sooting Flame Direct Numerical Simulation", December 2020 - November 2021; "Investigation of Irregular Combustion Phenomena in SI Engines using Large-Eddy Simulations", December 2020 - November 2022; "Flame kernel development in hydrogen/air mixture", December 2020 - November 2021

XSEDE Production Allocation, **Co-PI for the project** "Direct Numerical Simulation investigation of Heat Release Effects on Turbulence Dynamics and Energy Transfer", April 2017 - March 2018

NERSC Production Allocation Award, **Co-PI for the project** "Direct Numerical Simulations of Turbulent Combustion: Heat Release Effects on Turbulence Dynamics and Energy Transfer", 2016, 2017 and 2018

NERSC Production Allocation Awards, **Co-PI for the project** "Parallel Adaptive Wavelet Method for the Simulation of Compressible Reactive Flow", 2012, 2013, 2014, 2015, and 2016

XSEDE Startup Allocation, **Co-PI for the project** "Direct Numerical Simulation investigation of Heat Release Effects on Turbulence Dynamics and Energy Transfer", 2016

ISCRA Class B Project for HPC, **Co-PI for the project** "Simulation of a turbulent reacting mixing layer using a Wavelet Adaptive Multi-Resolution Method", 2013

Awards

Kaneb Center Outstanding Graduate Student **Teacher Award**, 2012

Professional Service

Reviewer for *Combustion and Flame*, *Combustion Theory and Modelling*, *Journal of Computational Physics*, *Journal of Propulsion and Power*, *Proceedings of the Combustion Institute*, *Fuel*, *Journal of Heat and Mass Transfer*, *Atmosphere*, *Fluids*, *American Society of Mechanical Engineers Turbo Expo*, and *27th International Colloquium on the Dynamics of Explosions and Reactive Systems (ICDERS)*.

Reviewer for computing time proposal for *High Performance Computing Center Stuttgart (HLRS)*, *Jülich Aachen Research Alliance (JARA)*, National High Performance Computing Alliance (NHR), and RWTH Computing Project.

Session Chair

- *Premixed DNS II, 18th International Conference on Numerical Combustion*, San Diego, USA, May 8th - 11th, 2019
- *Numerical Methods, 17th International Conference on Numerical Combustion*, Aachen, Germany, May 6th - 8th, 2019
- *Turbulent Combustion Session, 37th International Symposium on Combustion*, Dublin, Ireland, July 29th - August 3rd, 2018
- *Sooting Flame Simulations Session, 2018 Eastern States Section of Combustion Institute Technical Meeting*, Penn State University, USA, March 4th - 7th, 2018

Program Committee Member of the *17th International Conference on Numerical Combustion*, Aachen, May 6th - 8th, 2019

Organizer of the *6th International Workshop on Model Reduction in Reactive Flow*, Princeton University, July 11th-14th, 2017

Member of *Graduate Student Senate*, University of Notre Dame, August 2012-May 2013

Invited Talks

T. Grenga, Advanced tools for a new combustion age. *Department of Engineering Science*, University of Oxford (UK), April 8th, 2022.

T. Grenga, Artificial Intelligence for future energy system. *AI4Media*, Online event, March 17th, 2022.

T. Grenga, Wavelet adaptive multi-resolution representation for compressible flow. *Department of physics and astronomy*, University of Bologna (Italy), April 4th, 2019.

T. Grenga, Compressible reacting flow: advanced methods for simulation. *Institute of Fluid Dynamics and Acoustics Technology*, Technical University Berlin (Germany), January 23rd, 2019.

T. Grenga, Compressible reacting flow: advanced methods for simulation and analysis. *Reacting Flow Center*, Sandia National Laboratory - Livermore (USA), May 7th, 2018.

T. Grenga, Compressible reacting flow: advanced methods for simulation and analysis. *Department of Mechanical Engineering*, University of Birmingham (UK), April 23rd, 2018.

T. Grenga, Compressible reacting flow: advanced methods for simulation and analysis. *Department of Mechanical Engineering*, University of Wisconsin Madison (USA), February 12th, 2018.

T. Grenga, Multi-dimensional compressible reactive flow: direct numerical simulation and analysis. *Department of Mechanical Engineering*, KAUST (Saudi Arabia), February 8th, 2017.

T. Grenga, Numerical solution of multi-dimensional compressible reactive flow using a parallel Wavelet Adaptive Muti-Resolution method. *Department of Mechanical Engineering*, KAUST (Saudi Arabia), November 3rd, 2016.

T. Grenga, Advanced Mathematical Tools for the Analysis of Chemical Kinetics and Reactive Flows. *Clean Combustion Research Center*, KAUST (Saudi Arabia), November 2nd, 2016.

T. Grenga, Numerical solution of multi-dimensional compressible reactive flow using a parallel Wavelet Adaptive Muti-Resolution method. *Center of Mixing Under Extreme Conditions (CoMuEx)*, Los Alamos National Laboratory (USA), October 16th, 2014.

T. Grenga, Numerical Solution of compressible reactive flow using a parallel Wavelet Adaptive Muti-Resolution method. *Environmental Fluid Dynamics Laboratories*, University of Notre Dame (USA), April 25th, 2014.

T. Grenga, G-Scheme-based mechanism simplification and analysis for hydrogen and hydrocarbon ignition. *Environmental Fluid Dynamics Laboratories*, University of Notre Dame (USA), April 29th, 2011.

Peer Reviewed Publications

Grenga, T., L. Nista, C. D. K. Schumann, A. N. Karimi, G. Scialabba, A. Attili, H. Pitsch, Predictive data-driven model based on generative adversarial network for premixed turbulence-combustion regimes. *Combustion Science and Technology*, **Accepted**, 2022.

Nista, L., C. D. K. Schumann, T. Grenga, A. Attili, H. Pitsch, Investigation of the generalization capability of a Generative Adversarial Network for Large Eddy Simulation of turbulent premixed reacting flows. *Proceedings of the Combustion Institute*, **Accepted**, 2022.

Chu, H., L. Berger, T. Grenga, Z. Wu, H. Pitsch, Effects of differential diffusion on hydrogen flame kernel development under engine conditions. *Proceedings of the Combustion Institute*, **Accepted**, 2022.

Deshmukh, A. Y., T. Grenga, M. Davidovic, L. Schumacher, J. Palmer, M. A. Reddemann, R. Kneer, H. Pitsch, A Reduced-order Model for Multiphase Simulation of Transient Inert Sprays in the Context of Compression Ignition Engines. *International Journal of Multiphase Flow*, **147**, 103872, 2022

Deshmukh, A. Y., M. Davidovic, T. Grenga, R. Lakshmanan, L. Cai, H. Pitsch, A Reduced-order model for turbulent reactive sprays in compression ignition engines. *Combustion and Flame*, **236**, 111751, 2022

Saha, A., T. Grenga, A. Y. Deshmukh, M. Davidovic, J. Hinrichs, M. Bode, H. Pitsch, Numerical modeling of single droplet flash boiling behavior of E-fuels considering internal and external vaporization. *Fuel*, **308**, 121934, 2022

Grenga, T., and M. E. Mueller, Dynamic mode decomposition: a tool to extract structures hidden in massive datasets. *Data Analysis in Direct Numerical Simulation of Turbulent Combustion*, Springer, 2020.

Valorani, M., F. Creta, P. P. Ciottoli, R. Malpica Galassi, D. A. Goussis, H. N. Najm, S. Paolucci, H. G. Im, E.-Al. Tingas, D. M. Manias, A. Parente, Z. Li, T. Grenga. Computational singular perturbation method and tangential stretching rate analysis of large scale simulations of reactive flows: Feature tracking, time scale characterization, and cause/effect identification. Part 1, basic concepts *Data Analysis in Direct Numerical Simulation of Turbulent Combustion* Springer, 2020.

Valorani, M., F. Creta, P. P. Ciottoli, R. Malpica Galassi, D. A. Goussis, H. N. Najm, S. Paolucci, H. G. Im, E.-Al. Tingas, D. M. Manias, A. Parente, Z. Li, T. Grenga. Computational singular perturbation method and tangential stretching rate analysis of large scale simulations of reactive flows: Feature tracking, time scale characterization, and cause/effect identification. Part 2, analyses of ignition systems, laminar and turbulent flames. *Data Analysis in Direct Numerical Simulation of Turbulent Combustion* Springer, 2020.

Nunno, A. C., T. Grenga, and M. E. Mueller, Comparative analysis of methods for heat losses in turbulent premixed flames using physically-derived reduced-order manifolds. *Combustion Theory and Modelling*, **23**, 42-66, 2019.

MacArt, J. F., T. Grenga, and M. E. Mueller, Evolution of flame-conditioned velocity statistics in turbulent premixed jet flames at low and high Karlovitz numbers. *Proceedings of the Combustion Institute*, **37**, 2503-2510, 2019.

Valorani, M., P. P. Ciottoli, R. Malpica Galassi, S. Paolucci, T. Grenga, E. Martelli, Enhancements of the G-Scheme Framework. *Flow, Turbulence and Combustion*, **101**, 1023-1033, 2018.

DeBuhr, J., B. Zhang, M. Anderson, D. Neilsen, E. W. Hirschmann, T. Grenga, and S. Paolucci, Relativistic Hydrodynamics with Wavelets. *Astrophysical Journal*, **867**, 112, 2018.

Grenga, T., J. F. MacArt, and M. E. Mueller, Dynamic mode decomposition of a direct numerical simulation of a turbulent premixed planar jet flame: convergence of the modes. *Combustion Theory and Modelling*, **22**, 795-811, 2018.

Grenga, T., S. Paolucci, and M. Valorani, Sensitivity analysis and mechanism simplification using the G-Scheme framework. *Combustion and Flame*, **189**, 275-287, 2018.

MacArt, J. F., T. Grenga, and M. E. Mueller, Effects of combustion heat release on velocity and scalar statistics in turbulent premixed jet flames at low and high Karlovitz numbers. *Combustion and Flame*, **191**, 468-485, 2018.

Sun, W., T. Grenga, and Y. Ju, Hybrid Multi-Timescale and G-Scheme method for efficient modeling with detailed chemical kinetics. *American Institute of Aeronautics and Astronautics (AIAA) SciTech 2017*, January 9–13, 2017.

Valorani, M., S. Paolucci, E. Martelli, T. Grenga, and P. P. Ciottoli, Dynamical system analysis of ignition phenomena based on tangential stretching rate. *Combustion and Flame*, **162**, 2963-2990, 2015.

Paolucci, S., Z. Zikoski, and T. Grenga, WAMR: An adaptive wavelet method for the simulation of compressible reacting flow. Part II. The parallel algorithm. *Journal of Computational Physics*, **272**, 842-864, 2014.

Submitted Papers

Fröde, F., T. Grenga, V. Le Chedanec, M. Bode, H. Pitsch, A three-dimensional cell-based Volume-of-Fluid method for conservative simulations of primary atomization. *Journal of Computational Physics*, **Submitted**, 2021.

Nista, L., C. D. K. Schumann, G. Scialabba, Grenga, T., Mathis, B., A. Attili, H. Pitsch, Influence of adversarial training on turbulence closure modeling with deep convolutional neural networks. *AIAA Journal*, **Submitted**, 2022.

Conference Publications

Nista, L., Sedona R., Grenga, T., Attili, A., Cacallaro G., Riedel M., Pitsch, H., Scalabilioty analysis of Super-Resolution Generative Adversarial Network training for turbulence closure model. *EuroHPC Summit week 2022*, March 22–24, 2021.

Fröde, F., Grenga, T., Le Chedanec, V., Pitsch, H., A conservative cell-based unsplit Volume of Fluid advection scheme for three-dimensional atomization simulations. *15th Triennial International Conference on Liquid Atomization and Spray Systems (ICLASS 2021)*, August 29 – September 2, 2021.

Saha, A., Deshmukh, A. Y., Grenga, T., Grunewald, M., Kaya, Y., Kirsch, V., Reddemann, M. A., Kneer, R., Pitsch, H., Numerical Modeling of the Flash Boiling Characteristics of E-Fuels at Low Ambient Pressure. *15th Triennial International Conference on Liquid Atomization and Spray Systems (ICLASS 2021)*, August 29 – September 2, 2021.

Saha, A., Deshmukh, A. Y., Grenga, T., Bode, M., Pitsch, H., Single Droplet Flash Boiling Characteristics of E-Fuels at Low Pressures: A Numerical Study *9th International Conference "Fuel Science – From Production to Propulsion"*, June 22–24, 2021

Grenga, T., Nista, L., Schumann, C. D. K., Karimi, A. N., Scialabba, G., Bode, M., Attili, A., Pitsch, H., Predictive data driven turbulence-combustion model through Super Resolution Generative Adversarial Network. *10th European Combustion Meeting*, April 14–15, 2021.

Deshmukh, A., Grenga, T., Davidovic, M., Pitsch, H., A Reduced-order Multi-zone Combustion Model for Turbulent Reactive Sprays in Compression Ignition Engines. *10th European Combustion Meeting*, April 14–15, 2021.

Nista, L., Schumann, C. D. K., Grenga, T., Karimi, A. N., Scialabba, G., Bode, M., Attili, A., Pitsch, H., Turbulent mixing predictive model with physics-based Generative Adversarial Network. *10th European Combustion Meeting*, April 14–15, 2021.

Attili, A., Sorace, N., Nista, L., Schumann, C. D. K., Karimi, A. N., Scialabba, G., Bode, M., Grenga, T., Pitsch, H., Investigation of the Extrapolation Performance of Machine Learning Models for LES of Turbulent Premixed Combustion. *10th European Combustion Meeting*, April 14–15, 2021.

Ren, Y., Yan, H., Grenga, T., Pilva, P., Pitsch, H., Deep learning-driven interpolation of experimental and simulation data of turbulent combustion. *10th European Combustion Meeting*, April 14–15, 2021.

Fröde, F., Ratuschny, C., Grenga, T., Bieber, M., Kneer, R., Tischendorf, R., Schmid, H-J., Pitsch, H., Large Eddy Simulation of the SpraySyn Burner Using a Three-Stream Flamelet Model. *10th European Combustion Meeting*, April 14–15, 2021.

Deshmukh, A. Y., Davidovic, M., Grenga, T., Schumacher, L., Kirsch, V., Palmer, J. Reddemann, M. A., Hofmeister, M., Wildenberg, A., Jacobs, S., vom Lehn, F. A. and Cai, L., Ottenwälder, T. S., Pischinger, S., Leonhard, K., Heufer, K. A., Schmitz, K., Kneer, R., Pitsch, H., Bio-hybrid Fuels: from Molecular Structure to Combustion and Emissions. *8th International Conference "Fuel Science – From Production to Propulsion"*, June 23–25, 2020

Grenga, T., Kleinheinz, K., A. Attili, H. Pitsch, Reduced order modeling for turbulent premixed flames with dynamic mode decomposition. *7th International Workshop on Model Reduction and Reactive Flow (IWMRRF)*, June 18–21, 2019.

Gemini, S., P. P. Ciottoli, R. Malpica Galassi, T. Grenga, S. Paolucci, and M. Valorani, Space-time adaptive reduction of unsteady flamelets. *7th International Workshop on Model Reduction and Reactive Flow (IWMRRF)*, June 18–21, 2019.

Baroncelli. M., T. Grenga, N. Hansen, H. Pitsch, Applying G-scheme based sensitivity analysis to aromatic formation pathways and comparison with experimental data. *7th International Workshop on Model Reduction and Reactive Flow (IWMRRF)*, June 18–21, 2019.

Zhang, T., T. Grenga, and Y. Ju, Analysis of premixed heptane/air cool flames at different Damkoler number. *7th International Workshop on Model Reduction and Reactive Flow (IWMRRF)*, June 18–21, 2019.

Kleinheinz, K., P. Maß, L. Berger, M. Bode, T. Grenga, A. Attili, H. Pitsch, Data-driven model development for CO emissions in stationary gas turbines. *9th European Combustion Meeting*, April 14–17, 2019.

Gemini, S., P. P. Ciottoli, R. Malpica Galassi, T. Grenga, H. Pitsch, S. Paolucci, and M. Valorani, Numerical generation of multidimensional flamelet databases using a parallel adaptive wavelet method. *9th European Combustion Meeting*, April 14–17, 2019.

Gemini, S., R. Malpica Galassi, P. P. Ciottoli, T. Grenga, S. Paolucci, and M. Valorani, Verified solutions of unsteady reacting flows using minimal degrees of freedom in space and time. *Combustion-DNS Strategy & Data Analysis Workshop*, May 22-23, 2018.

Grenga, T., J. F. MacArt, and M. E. Mueller, Multi-modal counterflow flames under autoignitive conditions. *2018 Eastern States Section of Combustion Institute Technical Meeting*, March 4–7, 2018.

MacArt, J. F., T. Grenga, and M. E. Mueller, Budgets of flame-conditioned second-order turbulence statistics in low and high Karlovitz number turbulent premixed jet flames. *2018 Eastern States Section of Combustion Institute Technical Meeting*, March 4–7, 2018.

Grenga, T., J. F. MacArt, and M. E. Mueller, Dynamic mode decomposition of a turbulent premixed planar jet flame. *10th Mediterranean Combustion Symposium*, September 17–21, 2017.

Valorani, M., P. P. Ciottoli, R. Malpica Galassi, S. Paolucci, T. Grenga, E. Martelli, Enhancements of the G-Scheme Framework. *10th Mediterranean Combustion Symposium*, September 17–21, 2017.

Sun, W., L. Wang, T. Grenga, and Y. Ju, Development of a Multiscale Adaptive Reduced Chemistry Solver (MARCS) for computationally efficient combustion simulations. *26th International Colloquium on the Dynamics of Explosion and Reactive System (ICDERS)*, July 30–August 4, 2017.

Grenga, T., J. F. MacArt, and M. E. Mueller, Identification of low-order dynamics in turbulent premixed flames with dynamic mode decomposition. *6th International Workshop on Model Reduction and Reactive Flow (IWMRRF)*, July 11–14, 2017.

Valorani, M., P. P. Ciottoli, R. Malpica Galassi, S. Paolucci, T. Grenga, E. Martelli, Enhancements of the G-Scheme Framework. *6th International Workshop on Model Reduction and Reactive Flow (IWMRRF)*, July 11–14, 2017.

Sun, W., L. Wang, T. Grenga, and Y. Ju, Multi-scale Adaptive Reduced Chemistry Solver (MARCS) for high-dimensional combustion modeling with detailed chemical kinetics. *6th International Workshop on Model Reduction and Reactive Flow (IWMRRF)*, July 11–14, 2017.

Grenga, T., and M. E. Mueller, Multi-modal counterflow flame structure under autoignitive conditions. *10th US National Combustion Meeting*, April 23–26, 2017.

Sun, W., L. Wang, T. Grenga, and Y. Ju, Comparative study of hybrid multi-timescale and g-scheme methods for MARCS with detailed chemical kinetics. *10th US National Combustion Meeting*, April 23–26, 2017.

MacArt, J. F., T. Grenga, and M. E. Mueller, Karlovitz number effects on velocity and scalar statistics in turbulent premixed combustion. *10th US National Combustion Meeting*, April 23–26,

2017.

Nunno, A. C., T. Grenga, and M. E. Mueller, Comparative analysis of methods for heat losses in physically-derived reduced-order manifolds. *10th US National Combustion Meeting*, April 23–26, 2017.

Grenga, T., S. Paolucci, and M. Valorani, G-Scheme-based simplification and analysis methodology for hydrocarbon ignition. *2016 Eastern States Section of the Combustion Institute*, March 13–16, 2016.

Nunno, A. C., T. Grenga, and M. E. Mueller, Large eddy simulation of radiation effects in CO2 and H2O diluted turbulent premixed flames. *2016 Eastern States Section of the Combustion Institute*, March 13–16, 2016.

MacArt, J. F., T. Grenga, and M. E. Mueller, Effects of small-scale heat release on turbulence scaling in premixed and nonpremixed flames. *2016 Eastern States Section of the Combustion Institute*, March 13–16, 2016.

Grenga, T., S. Paolucci, and M. Valorani, G-Scheme-based analysis methodology for hydrocarbon Ignition. *5th International Workshop on Model Reduction and Reactive Flow (IWMRRF)*, June 28–July 1, 2015.

Grenga, T., S. Paolucci, and M. Valorani, Chemical reductions do not necessarily lead to computational reductions. *4th International Workshop on Model Reduction and Reactive Flow (IWMRRF)*, June 19–21, 2013.

Valorani, M., S. Paolucci, E. Martelli, and T. Grenga, Dynamical system analysis of ignition phenomena. *4th International Workshop on Model Reduction and Reactive Flow (IWMRRF)*, June 19–21, 2013.

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Grenga, T., and S. Paolucci, Multiscale methods and applications in computational mechanics. *11th World Congress on Computational Mechanics (WCCM XI)*, July 20–22, 2014.

Brill, S. R. , T. Grenga, J. M. Powers, and S. Paolucci, Automatic error estimation and verification using an adaptive wavelet method. *11th World Congress on Computational Mechanics (WCCM XI)*, July 20–22, 2014.

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Grenga, T., and S. Paolucci, The simulation of a hydrogen-bubble reaction due to shock ignition. *2012 American Physical Society (APS) - Division of Fluid Dynamics (DFD)*, November 18–20, 2012.

Grenga, T., and S. Paolucci, Parallel wavelet adaptive multiresolution representation. *2012 American Society of Mechanical Engineers (ASME) - International Mechanical Engineering Congress and Exposition (IMECE)*, November 9–15, 2012.

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Valorani, M., S. Paolucci, and T. Grenga, G-Scheme analysis of the combustion of hydrocarbon fuels. *2010 Italian Section of the Combustion Institute Meeting*, June 27–30, 2010.

Posters

Grenga, T., G-Scheme: integration and analysis tool for reactive mechanism. *Research Computing Day - Princeton University*, October 14, 2016

Nunno, A. C., T. Grenga, and M. E. Mueller, Effects of flamelet manifold generation on flame structure and pollutants in diluted turbulent premixed flames. *Research Computing Day - Princeton University*, October 14, 2016

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Professional Memberships

- Combustion Institute (2010–present)
- American Physics Society (2011–present)
- American Society of Mechanical Engineers (2014–present)
- Society for Industrial and Applied Mathematics (2017–present)

Computer Skills

- Languages: Fortran, C, Python, Pascal, UNIX shell scripting.
- Parallel Programming: MPI parallel processing library, OpenMP, HPX-5.
- Numerical Analysis: Matlab, Mathematica, COMSOL.
- Version Control: Git, SVN, Jenkins, Trac.
- Software Verification: Totalview, DDT, MAP, CrayPat, Vampir.
- Software Visualization and Graphics: Paraview, Tecplot, Visit, EnSight, Adobe Illustrator, Adobe Photoshop, Inkscape.
- Operating Systems: Apple OS X, Unix/Linux, Windows.
- Desktop Editing and Productivity Software: Vim, Emacs, LaTeX, Microsoft Office, OpenOffice.org, Google Docs.