## Georgios Koutsakis


CONTACT INFORMATION

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RESEARCH INTERESTS

Energy, Heat Transfer, Fracture Mechanics, Hypersonics, Reactive Flows

EDUCATION

**University of Wisconsin–Madison**, Madison, Wisconsin, USA

Ph.D., Mechanical Engineering, Engine Research Center **Jun 2017 – Jul 2022**

– Title: "Unsteady Heat Conduction and Fracture Mechanics in Multilayer Engine Coatings"

**University of Western Macedonia (UoWM)**, Kozani, Greece

Diploma, Mechanical Engineering **Oct 2011 – Nov 2016**

ACADEMIC EXPERIENCE

**Harvard University**, Cambridge, Massachusetts USA

School of Engineering and Applied Sciences

*Postdoctoral Fellow in Materials Science and Mechanical Engineering* **Sept 2022 – present**

Develop novel radiation barrier materials for gas turbine engines and hypersonics.
Projects are funded by:

– **U.S. Office of Naval Research** (ONR) **Sept 2022 – present**
– **U.S. Department of Energy**
Advanced Research Projects Agency - Energy (DOE ARPA-E) **Sept 2022 – present**
– **U.S. Air Force** Office of Scientific Research (AFOSR) **Sept 2022 – present**

**University of Wisconsin–Madison**, Madison, Wisconsin USA

*Research Assistant* **May 2017 – Jul 2022**

Research projects funded by:

– **John Deere** Power Systems **Jan 2019 – Aug 2021**
– **General Motors** Propulsion Systems Research Lab **May 2017 – Dec 2018**

**Analytical/Numerical Model Development**

– Developed analytical wall surface temperature framework for multilayer engine walls using residue-calculus Laplace transform inversion techniques
– Generated high fidelity numerical thermal barrier coatings simulations using custom finite difference Crank-Nicolson solver
– Adapted the analytical approach to a user-defined function in GT-Power using Python and simulated drive cycles with in-cylinder thermal barrier coatings
– Developed a transient analytical durability mechanics method, adapted LayerSlayer software, to predict structural integrity of coated reciprocating engine hardware
– Developed optimization routine using a high-throughput computing framework for distributed parallelization to investigate the optimum piston coatings architecture based on heat transfer and durability constraints

*Teaching Assistant* **Jan 2020 – May 2020**

Co-taught lab sections undergraduate-level course "Elementary Heat Transfer" in Mechanical Engineering program. Shared responsibility for lectures, exams, homework/lab assignments, and grades. Various duties and responsibilities included:

- Lab discussion material preparation
- Delivered review lectures prior to exams
- Assisted students with homework assignments

## Professional Experience

**FEV GmbH**, Aachen, Germany

NVH Department (Noise, Vibration, Harshness)

ERASMUS *Intern Engineer* **Jul 2015 – Sep 2015**

Sensors installation for vibration and acoustics measurements on engine test bench; Used and operated measuring equipment for data acquisition. Developed a Matlab algorithm for transient engine events combustion noise separation based on a single-cycle analysis.

**University of State of São Paolo (UNESP)**, São Paolo, Brazil

Laboratory of Tribology & Vibration Analysis

IAESTE *Intern Engineer* **Sep 2014 – Dec 2014**

Worked collaboratively on the experimental setup investigating wear particles in lubricants *e.g.* Viscometer, XR-Spectrometer, Portable Particle Counter and Wear Test (Pin-on-Disk). Developed a non-linear spur gear pair vibration simulation with variable stiffness in Matlab. Participated in the Formula SAE Student Team Equipe Fênix Racing. Manufactured various parts of the car under construction using lathe and milling machines.

## Technical and Management Experience

**"Τυφoon MotoRacing UoWM" Project**, Kozani, Greece

*Team Leader* **Sep 2014 – Oct 2016**

First time a racing motorcycle designed and built by a Greek University student group. A MotoGP-3 racing prototype was designed and constructed and successfully participated in the IV International MotoStudent Competition in Aragón MotoGP, Spain October 2016; Ranked, overall, 9 out of 36 in its gas fuel category. Various activities throughout the project:

- Project Manager; organization of the group's structure into teams with specific assignments. Overall responsibility for the successful completion of the project; Overseeing all aspects of design and construction of the motorcycle which included:
  - Structural analysis *i.e.* Static and Dynamic simulations of the chassis and various components, Multibody Dynamics simulations of the vehicle.
  - Member of the Marketing & Sponsorship team.

**IAESTE**, Kozani, Greece
(International Association for the Exchange of Students for Technical Experience)

*Local Committee Coordinator* **Sep 2013 – Sep 2015**

Organized, hosted and assisted foreign students who arrived through the program. Assisted in finding jobs/positions for future exchange students. Acted as a link between the local industry and the international students.

## Honors and Awards

**SAE Myers Award for Outstanding Student Paper** 2020

Best Technical Paper authored and presented by a graduate student in SAE (Society of Automotive Engineers) WCX 2020, Detroit, MI USA

**SAE Student/Young Professional Tech Paper Competition** 2020

Selected by the SAE's Competition Review Panel as one of the two highest scored student papers. A honorarium was received and all-expenses were covered for the SAE WCX 2020, Detroit, MI USA

**Department of Mechanical Engineering Fellowship, UW–Madison** 2020

**Gerondelis Foundation, Inc. Scholarship** 2018

Graduate student scholarship for academic excellence

**Technical Chamber of Greece (TEE-TCG) for Academic Excellence** 2018
Highest class rank award given to the best graduate of each engineering department in the nation (class of 2016-2017), Athens Greece

**Honorary award from Dept. of Mechanical Engineering, UoWM, Kozani, Greece** 2014
Awarded based on academic performance criteria

**Honorary award by Thermaikos Municipality, Thessaloniki, Greece** 2011
2nd highest honor prize for high scoring in the 2011 National University Admission Exams

## Other Teaching Experience

**Private Tutoring**, Thessaloniki/Kozani, Greece **Sep 2010 – May 2017**
Prepared high school students for national qualification exams in Maths and Physics. Gave lectures and tutored small groups of undergraduate fellow mechanical and chemical engineering students from University of Western Macedonia and Aristotle University for their final exams.

## Publications

9. **Koutsakis, G.** and J.B. Ghandhi, "Optimization of Thermal Barrier Coating Performance and Durability over a Drive Cycle", International Journal of Engine Research (2022)
8. **Koutsakis, G.**, M.R. Begley, J.W. Hutchinson and J.B. Ghandhi, "Fracture-based Transient Thermo-mechanical Analysis of Reciprocating Engine Thermal Barrier Coatings", Engineering Fracture Mechanics (2022)
7. **Koutsakis, G.**, and J.B. Ghandhi, "Analytical Solution of Unsteady Heat Conduction in Multi-layer Internal Combustion Engine Walls", Applied Thermal Engineering (2022)
6. **Koutsakis, G.**, J. Saputo, E. Gingrich, M. Tess, S. Sampath and J.B. Ghandhi, "Delamination Failure on High-Output Diesel Engine Thermal Barrier Coatings", SAE Technical Paper (2022)
5. Babu. A, **G. Koutsakis**, S. Kokjohn, M. Andrie, "Experimental and Analytical Study of Temperature Swing Piston Coatings in a Medium-Duty Diesel Engine", SAE Technical Paper (2022)
4. Ghandhi, J. B. and **G. Koutsakis**, "Comment on "Numerical Approach to Define a Thermodynamically Equivalent Material for the Conjugate Heat Transfer Simulation of Very Thin Coating Layers" by P. Olmeda, X. Margot, P. Quintero, J. Escalona, International Journal of Heat and Mass Transfer, Vol. 162 (2020) 120377", International Journal of Heat and Mass Transfer (2021)
3. **Koutsakis, G.**, S. R. Miles and J. B. Ghandhi, "Assessment of In-Cylinder Thermal Barrier Coatings over a Full Vehicle Drive Cycle." SAE Technical Paper, No. 2021-01-0456 (2021)
2. **Koutsakis, G.**, and J. B. Ghandhi, "An Analytical Approach for Calculating Instantaneous Multilayer-Coated Wall Surface Temperature in an Engine." SAE International Journal of Advances and Current Practices in Mobility 2, No. 2020-01-0160 (2020): 1303-1313
(This paper received the Myers Award for Outstanding Student Paper and won the Student/Young Professional Tech Paper Competition in SAE WCX 2020)
1. **Koutsakis, G.**, G. F. Nellis, and J. B. Ghandhi, "Surface Temperature of a Multi-layer Thermal Barrier Coated Wall Subject to an Unsteady Heat Flux." International Journal of Heat and Mass Transfer 155 (2020): 119645

## Invited Talks

7. SAE WCX, Detroit MI 2022
6. John Deere, Engine Engineering Technical Seminar, Waterloo IA 2022
5. Engine Research Center Seminar, Madison WI 2021
4. MIT, Boston MA 2021
3. Direct-injection Engine Research Consortium Meeting, Madison WI 2020
2. SAE COMVEC (Commercial Vehicle Powertrain) Conference, Detroit MI 2020
1. Engine Research Center Seminar, Madison WI 2019

## Academic Service

**International Journal of Engine Research Reviewer** 2022 – present
**Journal of Energy Engineering Reviewer** 2022 – present

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| | **SAE Myers Award Committee Member** | 2021 – present |
| | **SAE WCX Reviewer** | 2020 – present |

COMPUTER SKILLS

**Languages:** Python, Matlab, LabVIEW, LaTeX
**CAD:** Solidworks, AutoCAD
**CAE:** ANSA/NASTRAN/$\mu$ETA, GT-Power

TECHNICAL SKILLS

Machining processes (lathe, milling), TIG/MIG welding and other metal fabrication processes, engines assembly, engine emissions bench operation, X-ray diffraction, Cleanroom: traditional/maskless lithography, electron-beam evaporation

PROFESSIONAL SOCIETY MEMBERSHIP

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| **American Institute of Aeronautics and Astronautics (AIAA) - Member** | Sept 2022 – present |
| **American Society of Mechanical Engineers (ASME) - Member** | Apr 2021 – present |
| **Society of Automotive Engineers (SAE) - Member** | Apr 2018 – present |
| **Member of the Student Council, UoWM, Kozani, Greece** | Sep 2013 – Sep 2014 |
| **Scout Volunteer, Greek Scouts Association** | Feb 2002 – Sep 2014 |
| **UoWM Alumni Association** | Dec 2020 – present |

REFERENCES

**Jaal B. Ghandhi** (Ph.D. advisor)
Grainger Professor of Sustainable Energy
University of Wisconsin–Madison
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**John W. Hutchinson**
Abbott and James Lawrence Research Professor of Engineering
School of Engineering and Applied Sciences, Harvard University
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**Gregory F. Nellis**
William A. and Irene Ouweneel–Bascom Professor
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**Matthew R. Begley**
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**David R. Clarke**
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