Curriculum vitae

Dr. Athanasios E. Giannadakis

Mechanical and Aeronautics Engineer

2026

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Contents

Summary

PERSONAL INFORMATION Athanasios E. Giannadakis

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ngiannad@gmail.com, tgiannad@upatras.gr, tgiannad@uop.gr, t.giannadakis@essencon.gr

Gender: Male, Date of birth: 14/05/1978, Nationality: Greek

Marital Status: Married with child, Military Obligations: Fulfilled

Foreign Languages: English (Proficiency)

FIELDS OF SPECIALIZATION / INTEREST

Thematic Areas: Transport Phenomena, Combustion, Reaction of Materials to Fire, Measurements of Fluid Thermal Parameters in Technological Flows (Outflow Beams, Thermal Plumes), Aerodynamic and Biological Flows, Energy Design of Installations, Energy Saving, Renewable Energy Sources

Measurement Techniques: Trachymetry of Orbital Particle Imaging (3D DPIV), Hot Wire Anemometry (HWA), Calorimetry (Shell and Cone), Temperature field measurement with thermocouples, Pressure measurement

Standards: EN ISO 17025, ISO 5660, ISO 1716, ELOT EN 13501

EDUCATION

(2002 - 2008) **PhD** E.U.P. Level: 8

UNIVERSITY OF PATRAS, School of Engineering, Department of Mechanical Engineering & Aeronautics, Department of Energy, Aeronautics & Environmental Engineering, Laboratory of Technical Thermodynamics, Supervisor: Dr. Thrasos Panidis

PhD Thesis Topic: "Combustion Systems with Swirl: Effect of external parallel flow on an inner swirling jet", Grade: Excellent

(1996 - 2001) **Diploma in Mechanical and Aeronautical Engineering** E.U.P. Level: 7

UNIVERSITY OF PATRAS, School of Engineering, Department of Mechanical Engineering & Aeronautics, Laboratory of Fluid Mechanics and Fluid Applications, Supervisor: Dr. Dionysios Margaris

Thesis Topic: "Three-phase flow of hydropneumatic pump", Grade: 10.0

Grade: 8.04

Honours and awards Scholarships for academic performance by the State Scholarships Foundation and the Technical Chamber of Greece during the second to fifth year of undergraduate studies as well as for the diploma grade.

AUTHORSHIP

Monographs: **2**

Papers Published in International Journals or Conference Proceedings with DOI: **24**

Papers Published in International Conferences: **22**

Papers Published in National Conferences: **7**

Poster Papers in International Conferences: **3**

TEACHING EXPERIENCE

(01.01.2018-30/06/2019) Teaching of the course "Thermal Installations" at the Department of Electrical and Computer Engineering of the University of Patras

(2009–present) Research Associate of the Department of Mechanical Engineering, TEI of Western Greece

Professor PD407/80 at the University of Peloponnese, Adjunct Lecturer

Independent teaching of courses: Mechanical Design II, Fluid Mechanics, Internal Combustion Engines, Heating, Refrigeration, Air Conditioning, Thermal Installations, Energy Design and Air Conditioning of Buildings, Basic Principles of Turbomachinery, Hydro machinery, Mechanical Installations and Structures, Design of Mechanical Installations I & II, Metrology, Supervision of Dissertations

(2003 – 2008) Provision of Auxiliary Work to the Department of Mechanical Engineering & Aeronautics"

Course teaching: Technical Thermodynamics, Heat Transfer

PROFESSIONAL EXPERIENCE

(2008–present) Research Associate at the Laboratory of Technical Thermodynamics, Department of Mechanical Engineering & Aeronautics, University of Patras

Participation in European Programs: **3,** Participation in National and Co-funded Programs: **10**

(2003–present) Designer-Supervisor in E/M installations of private projects

Design-Supervision-Construction of Private Projects, Energy Control of Industrial Installations

PROFESSIONAL TRAINING

05.07.2018 - 06.07.2018 Attending a Seminar on Energy Audits

Guide for Energy Audits during End Use according to Law 4342/2015, TUV HELLAS

08.11.2010 - 08.12.2010 Training Course – for Qualifying Installers in Photovoltaic Systems

Educational Center for Solar Technology (BZS), Munich, Germany

08.09.2008 Attendance at ISO-17025 Training Program

Standard requirements ELOT ISO/IEC 17025 – Quality System, Laboratory, Internal Audits, Q-PLAN, Building Excellence

MANAGEMENT EXPERIENCE

Member of Organizations/Bodies

President Technical Chamber of Greece, Department of Western Greece (18.06.2010 to 13.01.2017)

Member of the Management Committee of the Technical Chamber of Greece (06.05.2017-18.11.2018)

Member of the Innovation Council of the Region of Western Greece (2011-2013)

Member of the Joint Monitoring Committee of the Program Agreement for the project "Creation of Decentralized Natural Gas Supply Systems in the PDE"

Μέλος Combustion Institute-Greek Section

Member of ERCOFTAC

Administrative Supervision Coordination of National and Co-funded Study and Training Programs: **3 (121 k€)**

Organization-Co-organization-Participation in Scientific and Development Workshops: 100

Supervision of Scientific Project Teams: 40

Professional Experience

(2008–present)

Research Associate at the Laboratory of Technical Thermodynamics, Department of Mechanical Engineering & Aeronautics, University of Patras

UNIVERSITY OF PATRAS, School of Engineering, Department of Mechanical Engineering & Aeronautics, Department of Energy, Aeronautics & Environmental Engineering, Laboratory of Technical Thermodynamics University Campus Rio 26500, Tel.: 2610 969436, Manager: Mr. Th. Panidis

- Participation in the writing of research proposals for funding (European-National). Participation in the Implementation of Research Programs.

Category : Research and Development

(2007–present)

Quality Assurance System Technician according to ISO-17025 for "Reaction to Fire Tests" at the Technical Thermodynamics Laboratory of the Department of Mechanical & Aeronautical Engineering

UNIVERSITY OF PATRAS, School of Engineering, Department of Mechanical Engineering & Aeronautics, Department of Energy, Aeronautics & Environmental Engineering, Laboratory of Technical Thermodynamics University Campus Rio 26500, Tel.: 2610 969435, Manager: K. Perrakis

- Characterization of building materials in terms of reaction to fire according to ISO 5660

Category : Technical Tests

(2003–present)

Designer-Supervisor in E/M installations of private projects-Energy Auditor

Freelancer

Design and supervision in Electrical - Mechanical Installations of private building and industrial projects: Natural Gas Networks - Hydraulic Networks - Fire Safety of Installations - Energy Performance of Buildings - Cooling - Heating Systems - Lifting Systems - Licensing of industrial installations - Energy Audits of Industrial and Commercial Buildings and Facilities with total energy consumption over 200 GWh and surface over 350.000 m^2.

Category : Design - Construction

(1999)

Internship at TITAN S.A. (Kamari Plant)

Scope of Internship: Statistical analysis of faults - stops of operation of a cement mill complex. Supervisor: Mr. Panicos Trakidis (Plant Manager during the current period)

Duration: One month

Category : Internships

Participation in Research Projects

Completed Research Projects

01. "Staged Combustion Devices", Karatheodoris, 2001, (University of Patras), Principal Investigator: T. Panidis, participation as researcher (**Duration: 6 months,** 01.02.2002-31.07.2002).

This research project concerned the design of gradual combustion systems for industrial applications without imposing a particular geometry, incompatible with the needs of the application. The project was carried out with the experimental and computational study of the interaction of a strong with a weak outflow beam, in the context of which the utilization of the characteristics of coherent structures was investigated in order to achieve the successful implementation of the method and in particular the "Rapid cooling" stage which is the most important for reducing NOx production and presents the greatest design difficulties. The originality of the program lies in the fact that for the first time coherent structures are used not as a side auxiliary phenomenon but as a tool both for stabilizing the flame and for achieving optimal mixing

02. "Research and development of combustion systems for Glass Furnaces - Minimization of NOx Emissions with optimal energy efficiency", 99BE368-PAVE99, funded by YIOULA GLASS INDUSTRY S.A., Scientific Coordinator: K. Perrakis, participation as researcher (**Contract duration: 3 months**, 01.08.2002-31.10.2002)

This research project concerned the design of combustion systems for glass ovens with high energy efficiency and significantly reduced emission of NOx and generally gaseous pollutants compared to conventional systems. Since the creation of NOx, which is the most difficult to reduce pollutant, is due to the presence of nitrogen in the oxidizer and the development of high temperatures in the combustion area, the research effort was based on the achievement of the following objectives such as the design of a combustion system using oxygen-enriched oxidizer (oxy-fuel burning) and the investigation of the possibilities of a gradual combustion system RQL (Rich burn - quick Quench - Lean burn / Rich combustion - rapid cooling - Weak burning).

03. **"Combustion Systems with Swirl"** EPEAEK funding 32 k€ (IRAKLITOS 2.2.649). Principal Investigator: **Th. Panidis,** participation as researcher and main author of the PhD proposal (**Contract duration: 2 years and 11 months,** 08.11.2002-07.09.2005)

This research project concerned the study of combustion schemes using swirl flows. Measurements taken regarding statistically mean and turbulent flow field (velocities, turbulence, turbulence intensity, Reynolds stresses, upper moments, frequency spectrum, flow visualization) and were performed with the methods of Tachymetry Imaging Orbital Particles and Hot Wire Anemometry

04. **"Environmentaly Compatible Air Transport System – ECATS"** (2005-2010), European Union Funding (EU-AERONAUTICS, NoE), Principal Investigator: **Th. Panidis**, participation as researcher (**Contract duration: 2 years and 10 months,** 01.03.2006-14.01.2010)

This research project concerned the study of the environmental impact of aviation within the European Union through the development of research on the following thematic areas:

1. Production of pollutants from engines and physical and chemical configuration of pollution components in the created plumes. (Kyoto compatibility study – Proposals for improving fuels and combustion systems in order to reduce emissions)
2. Air quality at local and wider reference scale (Study of pollutant emission sources and pollutant propagation in order to create reliable forecasting models)
3. Management and planning of sustainable aviation (Study of the existing situation and search for operational and technological parameters in order to make it possible to shape European aviation to be more environmentally friendly)

05. "Reinforcement of the existing infrastructure of the Laboratory of Technical Thermodynamics for the provision of testing services", GSRT Funding (CERTIFICATION), Scientific Coordinator: Th. Panidis – K. Perrakis, participation as researcher

This research project concerned the preparation of the EMF for the implementation of its accreditation according to the standard EN ISO/IEC 17025 in the provision of measurements in materials' reaction to fire via Cone Thermometer measurements. Within the framework of the project, I was trained and certified on the procedure of EN ISO/IEC 17025 and the use of this method.

06. "Fire Risk Assessment and Increase of Passenger Survivability", AIRCRAFTFIRE, 2011¬2014, FP7-2010-265612-CP-FP, Funding: EU, Partners: CNRS, Fraunhofer, Airbus, EADS, CAA, IFA, U. Greenwich, FireSERT, CORIA-INSA, U. Edinburgh, TREFLE, TUDelft, Principal Investigator: Th. Panidis, participation as researcher and member of the drafting team of the proposal (**Contract duration: 2 years, 01.01.2011-31.08.2017**)

This research project concerned the development of new knowledge on aircraft fire safety (testing of new materials using Calorimeter Cone, TGA, FTIR, experimental and computational simulation of fire evolution in inaccessible areas, development of genetic algorithms for the determination of thermophysical properties of materials, etc.). During the implementation of the relevant research program, I was involved in the study of the reaction of aviation materials to fire and the determination of their thermophysical properties using computational models of genetic algorithms. Finally, I was involved in the design of an experimental device simulating the spread of fire in inaccessible aviation spaces and the determination of the thermal quantities of the field using Cone Calorimetry.

07. "Experimental Investigation of Hemodynamic Field of Blocked Artery with Multiple Stenosis", Funding: KARATHEODORI (2010-2013), Principal Investigator: Kostas Perrakis, participation as researcher and main author of the proposal

This research project concerned the experimental and computational study of axisymmetric, steady-state and pulsatile flow, with successive stenosis under conditions simulating blood circulation in the central aorta area. The experimental study was done using the 2D DPIV method.

08. "RES+Installers", FP7 (2010-2013), Εταίροι: WIP – Renewable Energies, Munich, Germany, BZS - Municipal Training Centre for Solar Technology, Munich, Germany, ALP – Dillingen, Academy for In-Service Training and Staff Development, Dillingen a.d. Donau, Germany, AIE – European Association of Electrical Contractors, Brussels, Belgium, FIEC – European Construction Industry Federation, Brussels, Belgium, VHSE - Vocational High School of Electronics "John Atanasov", Sofia, Bulgaria, SCV - School Centre Velenje, Velenje, Slovenia, CRES - Centre for Renewable Energy Sources and Saving, Athens, Greece, Cracow University of Technology, Krakow, Poland, ASSISTAL - Italian Contractor's Association, Milano, Italy, Chamber of Mechanical & Electrical Engineers of Western Greece, Patras, Greece, συμμετοχή μέσω του ΠΣΔΜΗ ως υπεργολάβος του ΚΑΠΕ

This research project concerned the training of trainers who will provide certified seminars for small-scale RES system installers. During the implementation of the program, I was trained in Germany on the installation and operation specifications of RES units.

09. ARCHIMEDES III (2012-2015): **Investigation of hemodynamic field in the anastomosis area of occluded arteries** (Scientific Coordinator: Dr. Ioannis Kalogirou)

This research project concerned the experimental study of the hemodynamic field of the artery anastomosis area considering the effect of the presence of stenosis. The study concerns the effect of the angle of anastomosis and the relative position of the anastomosis in relation to stenosis, under conditions of permanent and pulsed flow. The experimental investigation of the flow field was carried out using the Digital Particle Image Velocimetry method and visualization of the formed hemodynamic field.

10. Integrated Energy and Environmental Utilization of Olive Oil By-Products (MIS 5045458) [DER6-0021057] (09/06/2021 to 31/10/2021) (Principal Investigator: Dr Michael Kornaros.) **(Contract duration: 5 months**, 09.06.2021- 31.10.2021**)**

This research project concerned at the development of a rapid anaerobic digestion system of olive oil production by-products, towards the production of biofuels to partially meet the energy needs of the olive oil mill or olive-pomace mill in which the unit will be installed. The project also studies physicochemical methods of removing solids from both the raw material and the runoff of the anaerobic unit. The solids will be used together with other agricultural waste to produce compost.

11. Financial support for research, development & innovation projects in the priority area of RIS3

"AGRODIATROFI", ROP of Western Greece (2019-2021): Upgrading of an Olive Husk Processing Unit for the Production of High Added Value Products. (Principal Investigator: Alexandros Romeos, Dr. Chemical Engineer, (**Contract Duration**: **1 year and 5 months,** 01.07.2019-31.12.2020)

This research project concerned the upgrading of the nutritional and commercial value of the products produced by a pomace oil mill by applying innovative and technologically mature methods that will be applied throughout the processing process. At the same time, the project aims to drastically upgrade the operation of the plant through the improvement of the deodorization process and the energy and waste management system with the production of new secondary products

12.Research-Create-Innovate B' Cycle", Competitiveness, Entrepreneurship & Innovation (EPAnEK): "Production of High Value Dried Organic Agri-Food Products, Using Innovative Freeze-Drying Applications", 2020-2022, (Principal Investigator: Alexandros Romeos, Dr. Chemical Engineer, **Contract Duration**: **1 year and 3 months** 01.04.2021-20.07.2022)

This research project aimed to develop domestic know-how for the production of innovative dried organic agri-food products, of high nutritional value and increased distribution time, through the creation of a pilot Lyophilization unit, of medium capacity. The final deliverables of the project are expected to be of technological maturity 8 (TRL 8) since the Freeze-Drying unit that will be built will be fully operational, while it is planned to have the production of innovative dried organic products by the participants in the implementation of the proposal Agricultural Cooperatives as well as promotion and promotion of the products in the international market, with their presentation in international exhibitions.

13.Greece-China Bilateral and Multilateral R&T Cooperation (2019-2022): High efficiency heat dissipation and energy saving for ultra-high power electronic devices with burst spraying technique (Principal Investigator: Thrasos Panidis) (**Contract duration: 2 years and 16 months,** 21.02.2020-30.09.2023)

This research project concerned the development of an innovative, adaptive and self-regulating closed circuit power electronics cooling device using burst spray. Relevant techniques are in the development phase with positive results, however there are still open questions regarding their performance, applicability and technological maturity. The proposed project foresees the experimental, theoretical and computational study of an innovative cooling system in order to determine its fluid thermal characteristics as well as the construction of special surfaces using nanotechnology, with enhanced heat dissipation capabilities.

Ongoing Research Projects

01. ELKE University of Patras: "Reaction to Fire Tests", K.E.-38780000 (Principal Investigator: Thrasos Panidis/Romaios Alexandros)

This project concerns the research and development of technological and building materials, in the light of their reaction to fire. The experimental study of the materials is carried out by the Cone Calorimetry method.

Research Development

Experimental Measurement Methods

Particle Image Velocimetry (2D-3D DPIV)

During the preparation of my doctoral dissertation, I have been a key factor in the development of the relevant measurement method since 2003. The two-dimensional Tachymetry of Orbital Particle Imaging is the basic measurement method with which I carried out the experimental measurements for the preparation of my doctoral dissertation. In this context, I also developed a computational code for the processing of raw data in order to extract higher statistical quantities for the better interpretation of the flow field. In addition to the aforementioned measurements, with this method I have conducted experimental measurements and research in free outflow beam flows, thermal plumes and biological flows in central artery simulation models. After the completion of my PhD thesis and due to the upgrade of the measuring infrastructure of the Technical Thermodynamics Laboratory to a three-dimensional DPIV system, I attended a specialized seminar in Germany by LaVision.

Hot Wire Anemometry (X Probe HWA)

During the preparation of my PhD thesis, I have been a factor in the development of the relevant measurement method since 2003. The Hot Wire Anemometry method was the first method by which I conducted measurements during the preparation of my doctoral dissertation. In this context, I specialized in the manufacture and repair of multi-wire sensors but also in the development of computer code for the processing of measurements.

Cone Calorimeter

In the context of upgrading the logistical infrastructure of the Technical Thermodynamics Laboratory, I was a key factor in the development of the Cone Calorimetry measuring device for the study and research of the reaction of building materials to fire and its accreditation by ESYD according to ISO 17025 for conducting tests according to the ISO 5660 series of standards.

Bomb Calorimeter

In the context of upgrading the logistical infrastructure of the Technical Thermodynamics Laboratory, I was a key factor in the development of the Shrapnel Calorimetry measuring device for the determination of the Calorific Value of solid and liquid fuels according to ISO 1716.

Thermography

In the context of the implementation of Energy Audits in Industrial and Commercial Facilities, I have conducted various thermal analysis reports of mechanical and electrical devices using thermography means.

Measuring devices

Below are presented three basic measuring devices developed for the needs of the Laboratory of Technical Thermodynamics of the Department of Mechanical Engineering & Aeronautics and collaborating industry. In these provisions, I was solely responsible for their design and construction.

Heating Probe

Over the last three years, the Laboratory of Technical Thermodynamics, with which I collaborate as a researcher, has developed strong cooperation ties with the VIOHALCO Group and specifically with the companies of the Hellenic Cables and Halcor Group. As a collaborator of the Laboratory but also individually as a freelance engineer, for the needs of HALCOR company, I designed and developed a measuring device for the control of insulation materials used in copper tubes, in relation to their resistance to temperature. Characteristic photographs of the layout are shown below (figure 1).

Figure 1. Photos of a measuring device for checking copper tube insulation materials for resistance to high temperatures

Hidden Zone Fire Apparatus (HZFA)

The experimental device HZFA was designed and manufactured within the framework of the European research program AircraftFire, in order to simulate the spread of fire in inaccessible (hidden) areas of an aircraft. The aim of the program was to study the mechanisms governing the ignition and spread of fire as well as the limitation of its spread, using composite materials. The main idea in the construction of the experimental device was based on the standard device (FIST) on which individual elements were added in order to simulate in the best possible way realistic operating conditions. A photograph of the layout is shown in Figure 2.

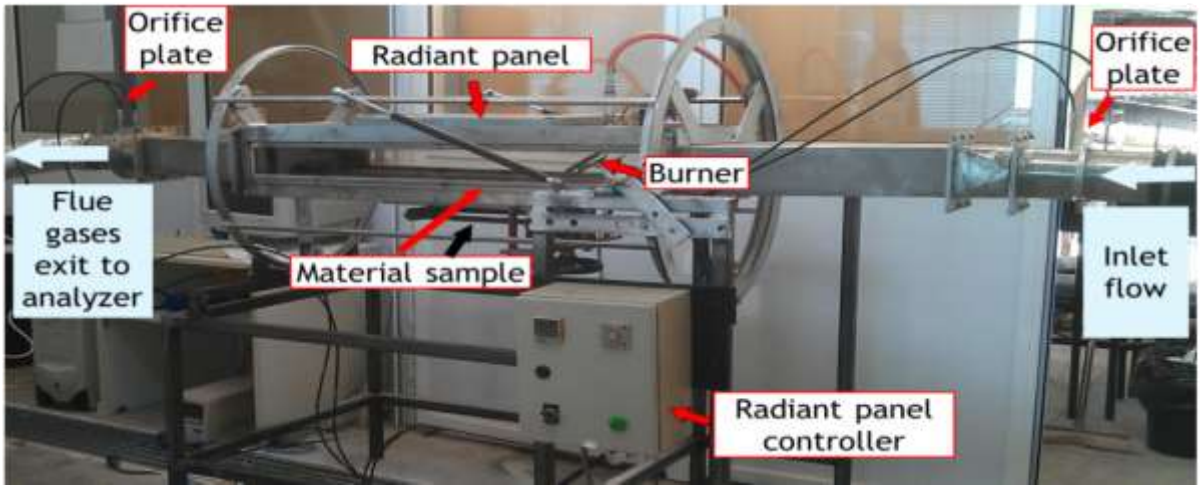


Figure 2. Experimental device to study the spread of fire in inaccessible areas of aircraft

Heated Gas Transfer and Spectral Analysis System with FTIR

As part of my collaboration with Special Devices Ioannis Sarris, we constructed a special heated gas transmission line as well as the corresponding heated variable length measuring cell for spectral analysis with FTIR.

Figure 3. Heated transmission line and measuring cell, for spectral analysis of gases with FTIR

Design and Construction of Prototype Energy Installations

Biogas Storage and Thermal Energy Production Unit

For the purposes of the research project "Integrated Energy and Environmental Utilization of Olive Oil By-Products", a mobile biogas storage and hot water/heating production unit was designed and constructed, which is housed in a 6m long container. The unit (Photo 1) consists mainly of four parts:

a. Biogas storage containers and compression system

The storage containers have been dimensioned and interconnected so that biogas production can be fed into the gas boiler for all possible production-use concurrency ranges, so as to exclude the possibility of biogas suction from the production reactor or "switching off" the burner due to low fuel drainage. In addition, a high-pressure vessel is used so that the biogas produced during non-working days can be safely stored and ready to supply the gas boiler when needed. For this purpose, a battery of low pressure tanks with a capacity of 500 litres is used, the operation of which is monitored and controlled by gauges and pressure sensors and the gas flow between the tanks is regulated by tubular valves, following a serial filling pattern. Then, when the pressure in the 4 low pressure tanks exceeds 30 mbar, the gas compression circuit is activated, feeding the high pressure tank (6 bar) which acts as a storage buffer tank and ensures the uninterrupted and safe supply of the burner.

b. Gas boiler and domestic hot water/heating production

For the thermal exploitation of biogas, a condensing gas burner with a rated heat output of 20 kW. The boiler can be configured so that different combustion schemes can be selected in terms of stoichiometry of the biogas produced (methane levels) since it is expected that its composition may vary in methane concentration. This ensures the proper operation of the burner and the uninterrupted production of Domestic Hot Water. The boiler is connected to an inertia tank (boiler) and to a network of pipelines for the supply of final recipients of domestic hot water or heating.

c. Digital Control Unit

The operation of the installation is monitored and regulated through a logic programming unit (PLC), consisting of a microprocessor system, a touch screen and peripheral controllers. Through the display of the control unit, the process of storage, feeding and combustion of biogas is displayed and adjusted. The logical configuration diagram of the installation is shown in Figure 1.

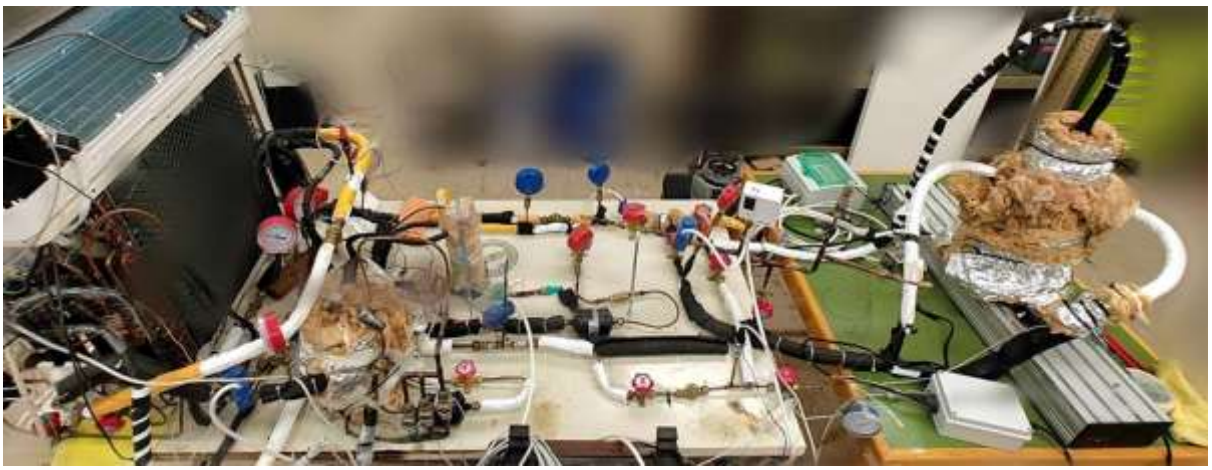
d. Fire Safety System

The installed active fire safety system includes gas detection sensors and thermodifferential detectors that end in a central control panel with audible announcement of an event, a gas supply blocking system, two permanent dry powder roof fire extinguishers placed above the burner and gas storage tanks as well as a portable 6kg dry powder fire extinguisher. In addition, an explosion-proof explosion-proof flue gas extraction duct with fireproof diaphragms has been installed along the pilot plant's housing.

Figure 1. Installation aspect

Experimental Study of Spray-Cooling Device

As part of the implementation of the research program "High Efficiency Heat Dissipation and Energy Conservation for Ultra-High Power Electronic Devices Based on Flashing Spray" of the Greece-China Bilateral Cooperation, a cooling device for ultra-high power electronics via Spray Cooling was developed, which was studied experimentally and computationally, in terms of its performance in various operating conditions but also for various cooling surface configurations with micromanufacturing and microstructures. To this, sophisticated temperature and pressure measurement devices were used throughout the cooling circuit, while speed measurements were carried out with the 2D Particle Image Velocimetry method and with digital pressure gauges, flowmeters and rapid response thermocouples, while electrical power consumption was also measured with the NGBT IoT platform.



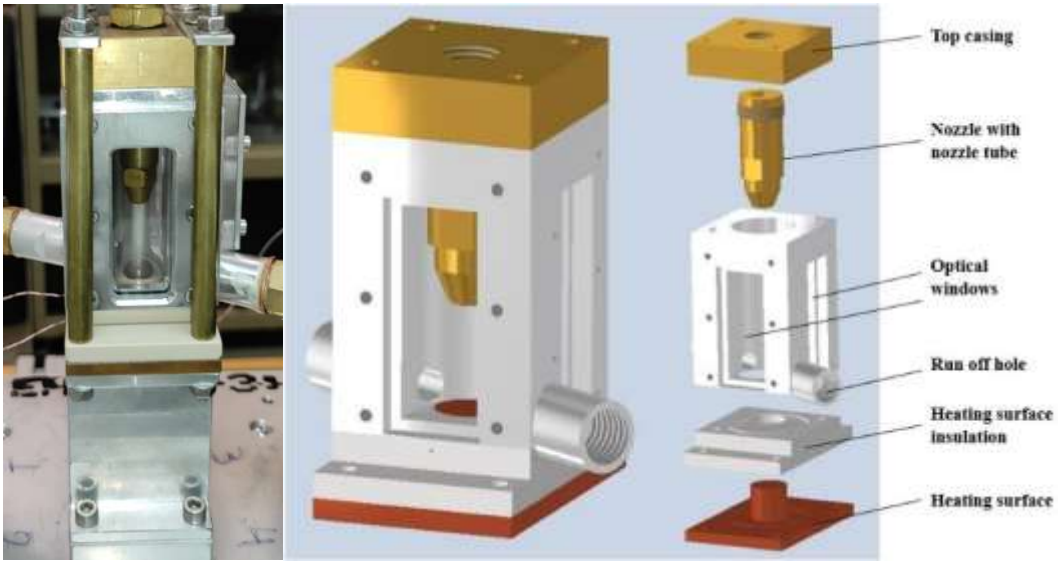


Figure 2. Layout and cooling chamber in operation

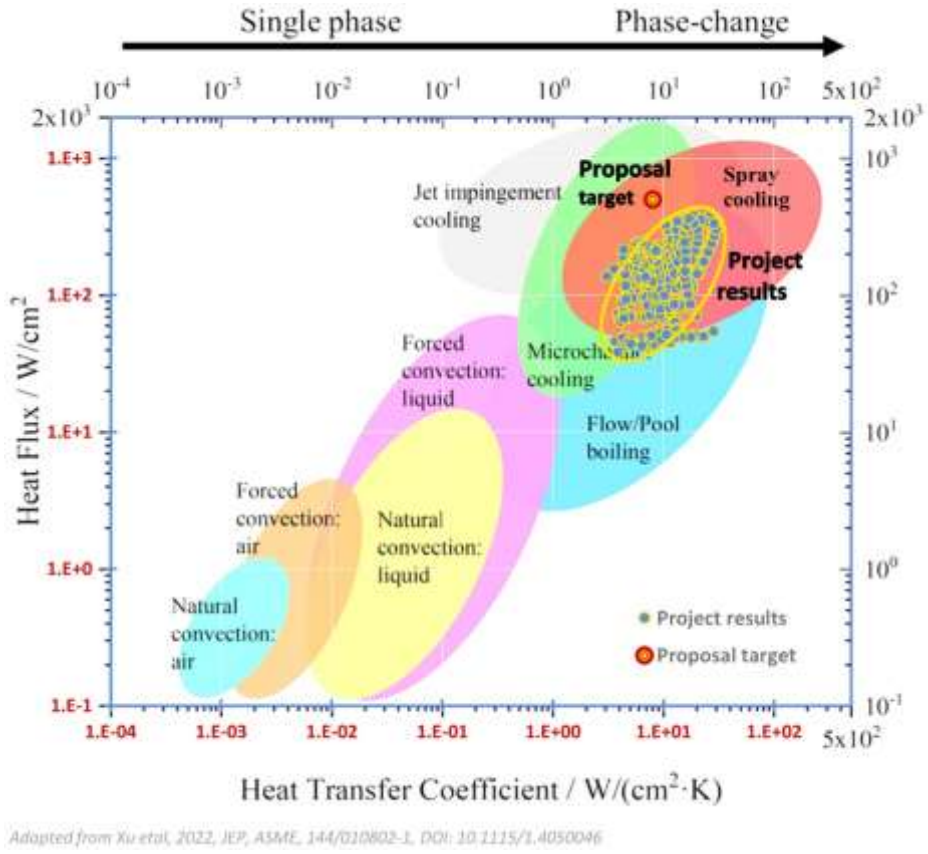


Figure 3. Mapping of experimental results and comparison with international literature

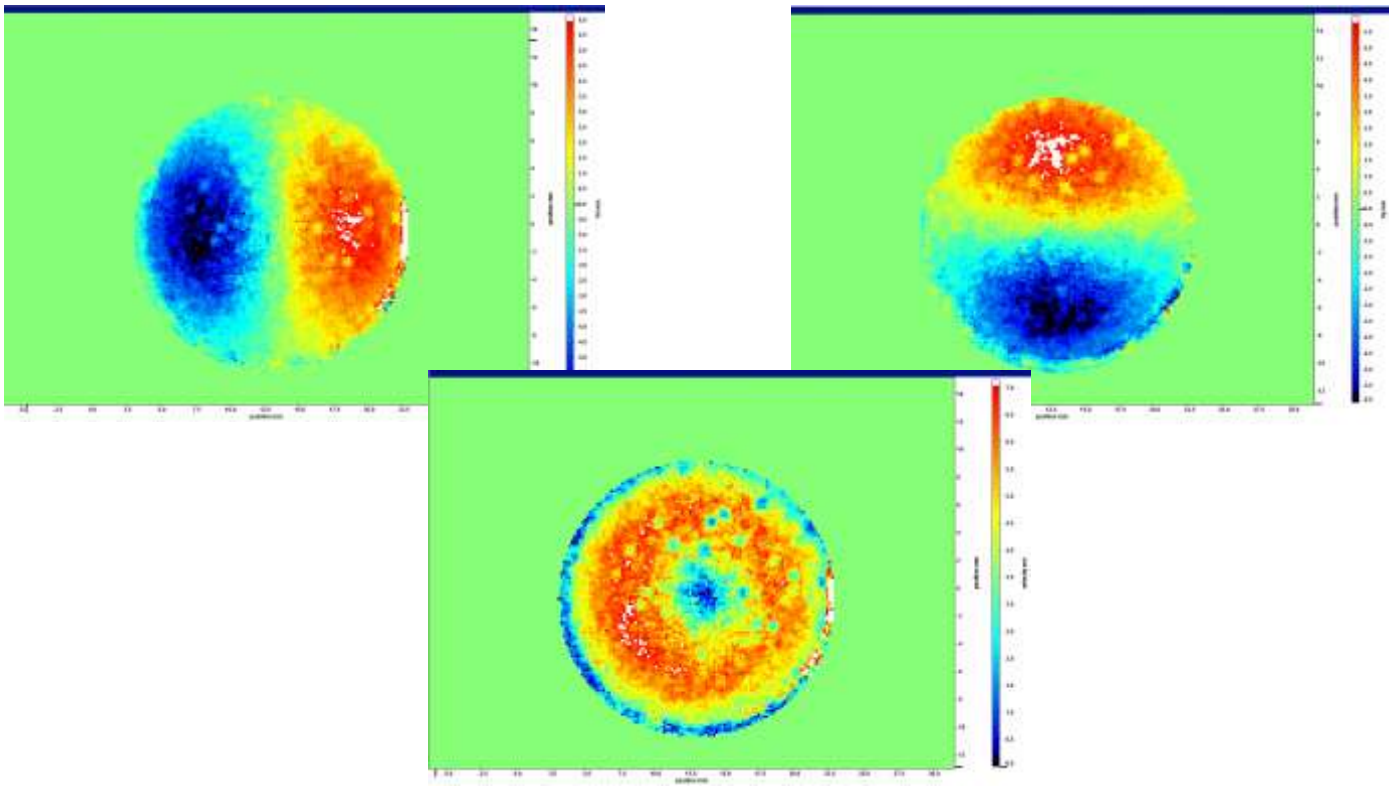


Figure 4. Velocity measurements via PIV.

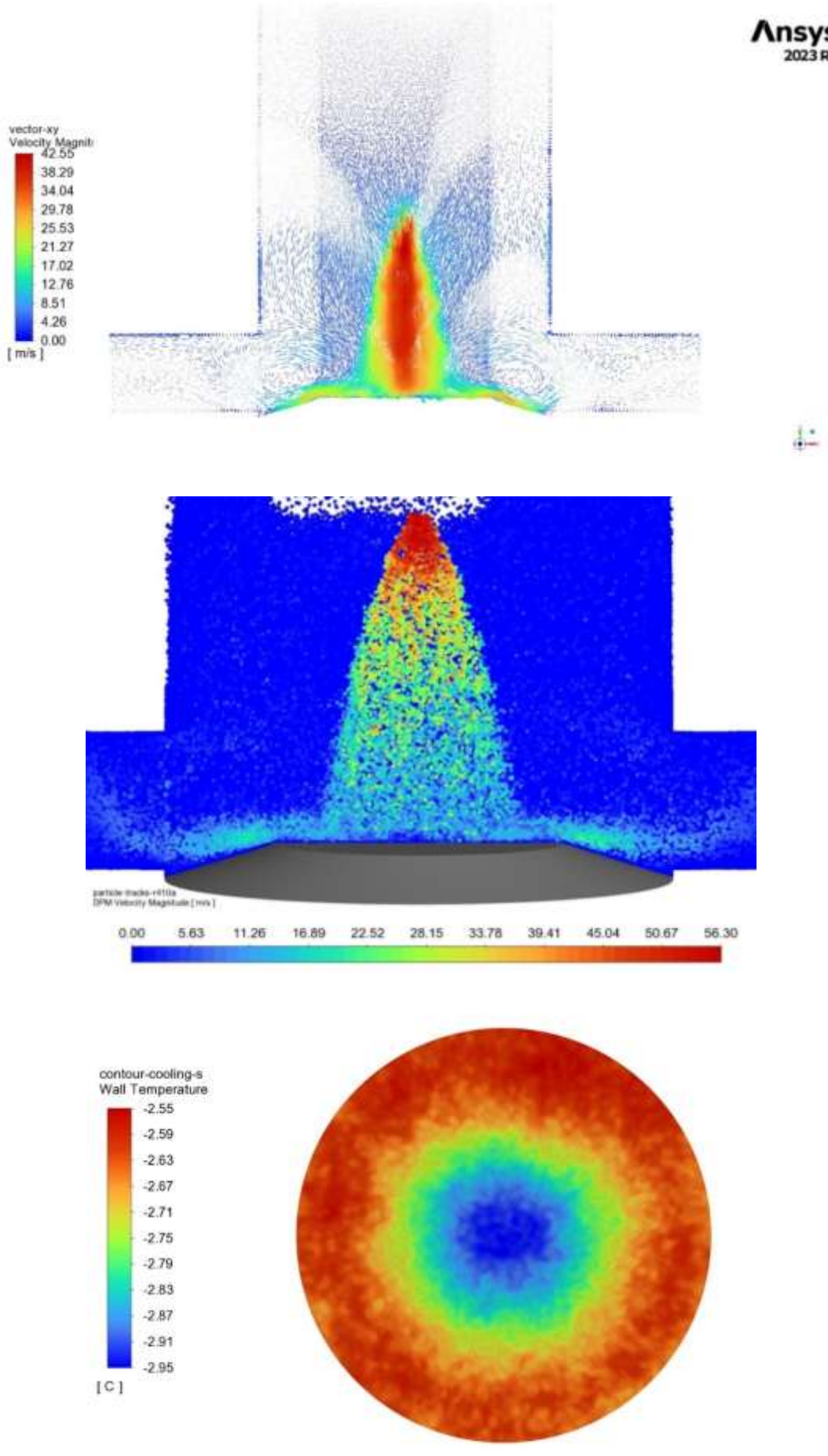


Figure 5. CFD Results

Research-Academic Collaborations

Reviewer in Scientific Journals

1. Journal of Fluids Engineering, Transactions of the ASME

Research Cooperation with Academic/Research Institutions

1. WIP Renewable Energies, Germany
2. Xi'an Jiaotong University, State Key Laboratory of Multiphase Flow in Power Engineering, China
3. Laboratory of Technical Thermodynamics and Applications of Statistical Mechanics of the Department of Mechanical Engineering and Aeronautics, University of Patras
4. Laboratory of Heating – Cooling – Air Conditioning of the Department of Mechanical Engineering of the University of Peloponnese
5. Laboratory of Electromechanical Energy Conversion, Department of Electrical and Computer Engineering, University of Patras
6. Laboratory of Biochemical Engineering & Environmental Technology, Department of Chemical Engineering, University of Patras
7. Decision Systems and Management Laboratory, School of Electrical and Computer Engineering, NTUA
8. Department of PV Systems and Distributed Generation of the Center for Renewable Energy Sources

Research Cooperation with Private Entities

1. AIRBUS, Aerospace Industry (France)
2. YIOULA Glass Industry SA (Attica)
3. HALCOR S.A. (Attica)
4. ZeroIgnition International, (Barbados)
5. Meazon S.A., Company for the Development, Manufacture and Operation of Smart Energy Meters (Patras)
6. Development Construction, Design and construction of nearly zero energy buildings (Kato Achaia)
7. Nikolopoulos Olive Oil Industry S.A., (Pyrgos, Ilia)
8. ELVAL HALCOR
9. HELLENIC CABLES S.A

Honours

Scholarships for academic performance by the State Scholarships Foundation and the Technical Chamber of Greece during the second to fifth year of undergraduate studies as well as for the diploma grade.

Recognition of Authorship

Google Scholar

	Total	Since 2021
Scitations	324	256
h-index	9	9
i10-index	9	9

Scopus

	Total
Scitations	237
h-index	9

Web of Science

	Total
Scitations	179
h-index	8

List of Publications

Publications in International Journals or Conference Proceedings with DOI

J01. **Giannadakis A**., Perrakis K., Panidis Th., 2008, A swirling jet under the influence of a coaxial flow, Experimental Thermal and Fluid Science, Vol. 32**,** pp: 1548-1563

The recirculating flow field generated by a swirling jet and a coaxial annular stream entering a pipe is investigated with the use of 2D-DPIV. Parametric change of inlet flow rates (constant tangential injection with change of annular flow and vice versa) is being considered in order to study the mean and turbulent flow field. A recirculation bubble stabilized close to the swirler exit is the dominating feature of the interaction between the inner swirling jet and the annular stream. Results are discussed in terms of bubble topology and dynamics on the basis of a modified Rossby number that appears to describe the trends of the complex flow field.

J02. **Giannadakis A**., Romeos A., Perrakis K., Panidis Th., 2011, Experimental Investigation of the Hemodynamic Field of Occluded Arteries with Double Stenosis, 10th International Workshop on Biomedical Engineering, DOI:10.1109/IWBE.2011.6079063

In the present work, the hemodynamic field of an occluded artery is studied experimentally. 2D D.P.I.V measurements are presented regarding the statistically mean and turbulent flow field created in an artery having a double stenosis with over 75% occlusion. In this manuscript, the steady state case is considered. Experimental results show the influence of the stenoses on the formation of recirculation zones and the effect of flow characteristics on the shear stresses developing in the artery model.

J03. Caneva, S., Weiss, I., Arancon, S., Hiegl, W., Janssen, R., Rutz, D., Helm, P., Kirchensteiner, W., Wolf, M., Schellekens, E., Campogrande, D., Nedelcheva, I., Papež, M., Tselepis, S., Magiera, Y., Nemish, Y., Esitini, M., Merrone, M., Pressas, S.A., **Giannadakis, T**., 2011, European Project Install RES: Training Courses for Trainers and Installers of Biomass Systems in Buildings, DOI: 10.5071/19thEUBCE2011-VP5.6.22

The Directive 2009/28/EC on the promotion of the use of energy from renewable energy sources sets an overall binding target of a 20% share of renewable energy sources in energy consumption by 2020 with binding national targets in line with the overall EU target of 20%. Details of how these targets will be achieved in each Member State are given in National Renewable Energy Action Plans (NREAPs). High qualified workforce is fundamental to guarantee the quality in the installation of Renewable Energy Systems (RES) to be installed to achieve the mandatory targets of the National Renewable Energy Action Plans (NREAPs) by 2020. This paper presents the first European training course for trainers (teachers and engineers) and installers (electricians, plumbers, roofers and technicians for heating systems) of small-scale renewable energy systems (heat pumps, biomass, solar and photovoltaic systems) in buildings offered within the European project “Install+RES”. The paper focuses on the “train the trainer” courses offered during the Install+RES project. The Install+RES “train the trainer” courses have been established in Munich, Germany, in German and English languages at the beginning of the Install+RES project. The PV module of the “train the trainer” courses was implemented at the end of 2010 and the solar thermal module of the “train the trainer” in German language was implemented in January 2011 in Munich, Germany. In the upcoming months the other modules of the “train the trainer” courses (heat pumps in English language and biomass modules both in German and English languages) will be also given in Munich, Germany. The idea behind the Install+RES project and the structure of the “train the trainer” courses will be presented in this paper providing detailed information on the training material and on the equipment utilized during the Install+RES “train the trainer” courses. This work will also highlight the innovative aspects of the Install+RES “train the

trainer" courses such as the "hand on learning" concept, "tandem teaching" approach and the "multiplier effect". The "train the trainer" courses are fundamental to further ensure the high quality of the Install+RES training courses for installers. During the "train for trainers" courses, the trainers acquire practical and theoretical knowledge to properly implement in their countries the training courses for installers of small-scale renewable energy systems. The Install+RES training courses for installers will be developed and established in several European countries (Bulgaria, Greece, Italy, Poland and Slovenia) in line with the requirements stated in the Directive 2009/28/EC on the promotion of the use of energy from renewable energy sources (article 14, Annex IV). The Install+RES training courses are meant to be an investment for sustainability by evolutionary processes, which will lead to the establishment of a high quality of skills and as consequence to the maximization of Renewable Energy Systems (RES)´s efficiency, reliability, lifetime and safety. The trainers and installers trained during the Install+RES training courses will be able to properly install the Renewable Energy Systems (RES) in their respective countries. This represents a fundamental step to ensure the achievement of the targets stated in the National Renewable Energy Action Plans (NREAPs) according to the Directive 2009/28/EC on the promotion of the use of energy from renewable energy sources. The Install+RES project started in May 2010 and will end in April 2013. The Install+RES project is co-financed by the European Commission in the framework of the Intelligent Energy Europe (IEE) program.

J04. Romeos A., **Giannadakis A.**, Perrakis K., Panidis Th., 2016, Co-Rotating Vortex Interaction, Aircraft Engineering and Aerospace Technology, Vol.88, pp: 285-293

The purpose of this paper is to study the structure and dynamic development of a pair of co-rotating trailing vortices, during their formation, interaction and merging, using detailed experimental measurements of the velocity and vorticity fields. The vortices were generated using two half wings (NACA0030) positioned at equal and opposite angles of attack at the entrance of the test section of an open-circuit, subsonic, wind tunnel. Velocity vector measurements were obtained at Rec = 133,000, on cross-plane grids at several distances from the trailing edges of the wings, using an in-house developed four-sensor hot wire anemometer probe. The results include cross-plane contour plots of the mean and fluctuating velocity as well as mean vorticity fields. Each of these variables is affected in a different way, providing complementary information on the development of the flow field. After shedding, the two vortices are swept along the stream-wise direction and spiral around each other, thereby developing a braid of two vortices, which then deforms the external flow field. Gradually, the interaction with the external flow field links both vortices together until the final merging and the formation of a new stable linear vortex emerges. Trailing vortices have been rendered particularly important during the past decades, because of increasing traffic density of very heavy aircrafts and several plane "incidents", which were attributed to the action of the vortex wake. The presented results provide information on the evolution and merging of a pair of vortices formed by a closely spaced differential wing configuration. The vortices interact almost immediately after shedding as expected in flap–flap or flap–wing vortices interaction.

J05. Kalogirou I. D., Romeos A., **Giannadakis A.,** Perrakis K., Panidis Th.**,** 2016**,** Flow patterns in an occluded artery with an end to side anastomosis model. A visualization study, International Journal of Biology and Biomedical Engineering**,** Vol. 10, pp: 159-167

The hemodynamic field of an occluded artery with a 45o distal 'end to side' anastomosis is examined experimentally. The influence of the host and graft vessel inlet conditions on the junction region flow dynamics are discussed, via a visualisation approach. A thin sheet of laser light, illuminating various sections along the test model, was used to analyse the local structure attained in the junction area, as well as in the proximal and distal regions of the merging section. In this study both the steady and pulsatile flow cases are considered. The qualitative description is obtained in a range of Reynolds and Womersley numbers typically occurring in human cardiovascular systems. Emphasis is placed on the detection of regions susceptible to deterioration of the bypass system performance associated in principle with swirl and backflow motion. The rearrangement of the hemodynamic field downstream of the anastomosis and its sensitivity to the merging

host and graft stream conditions is an issue of particular interest here, also.

J06. **Giannadakis A.**, Naxakis A., Romeos A., Perrakis K., Panidis Th., 2019, An experimental study on a coaxial flow with inner swirl: Vortex evolution and flow field mixing attributes, Aerospace Science and Technology, Vol. 94, DOI: 10.1016/j.ast.2019.105373

A 2D particle image velocimetry study of a coaxial flow with inner swirl is presented. An inner swirling jet, produced by tangential injection, interacts with an annular flow generating a recirculating flow field with strong mixing attributes. The characteristics of the cross-plane velocity components of four different test cases are presented (two levels of tangential injection flow rate combined with two levels of annular flow rate) in order to study the mean and turbulent attributes of the swirling vortex. The main features of this complex flow field, which can be considered as the interaction of a typical swirling jet undergoing “vortex breakdown” with an outer annular flow with “backward facing step flow” characteristics, are investigated, focusing on the swirling jet's characteristics. The analysis of the mean and turbulent flow is based on a modified Rossby number, previously proposed by the authors, defined as the ratio of the streamwise velocity jump across the two streams over a typical tangential velocity, which is shown to represent the ratio of the pressure difference due to the streamwise velocity difference and the entrainment of the two flows to that due to the rotation of the swirling vortex. The angular momentum diffusion downstream is evaluated, to assess the mixing between the swirling vortex and the outer flow.

J07. Papadogianni V., Romeos A., **Giannadakis A.,** Perrakis K., Panidis T., 2019, Cone Calorimeter and Thermogravimetric Analysis of Glass Phenolic Composites Used in Aircraft Applications, Fire Technology, DOI: 10.1007/s10694-019-00928-3

The increasing use of composite materials in aircraft cabins and structures poses significant challenges in order to maintain and improve the fire safety of aviation. In this work, the flammability characteristics of a commercial glass-fibre reinforced phenolic composite (GFRP) used for aircraft cabin partitions and furnishing are investigated experimentally. Thermogravimetric analysis under inert atmosphere at several heating rates provided information on the thermal decomposition process. The degradation process is modelled with one and two-step mechanisms using the Ozawa–Flynn–Wall iso-conversional method and the GPYRO numerical code which utilizes a genetic algorithm optimization scheme. The estimated activation energy and pre-exponential factor values, especially in the two-step case (77.18 and 104.69 kJ/mol and 2.60 × 106 and 3.19 × 106 min−1 for the first and the second step respectively), recover reasonably well the conversion degree and its derivative. Tests with a cone calorimeter (CC), performed at different incident heat fluxes, provided information on the reaction to fire characteristics of the material and the influence of the heat flux on the combustion process. In general, combustion proceeds in two stages, flaming and smoldering combustion. The CC results assisted by scanning electron microscopy photos provide information on the charring characteristics of the material. The critical heat flux for ignition and the corresponding ignition temperature are estimated, correlating heat fluxes with time to ignition. Thermally thin and thick models are considered, as well as a modified technique bridging the gap between these limit cases and therefore valid for thermally thin and thick but also intermediate conditions (more pertinent in the present case). The results for this latter approach are ~ 20 kW/m2 and Tig = 469°C, providing also complementing information on thermophysical properties, such as thermal diffusivity, $\alpha = 1.23 \times 10{-}7$ m2/s, thermal conductivity, k = 0.325 W/(m K) and specific heat capacity, c = 1.330 kJ/(kg K). This work provides information on the reaction to fire characteristics of GFRP, but also on physical and flammability properties in a form suitable to be used in numerical codes, for the prediction of fire and evacuation scenarios. The influence of the reinforcement structure on the fire behaviour of the composite is also illustrated and discussed.

J08. Naxakis, A., **Giannadakis, A.**, Perrakis, K., Panidis, T. (2020). Experimental Study on Coaxial Swirling Flows. International Review of Mechanical Engineering, 14(7)

The experimental investigation of a swirling jet and an annular swirling stream issuing from coaxial cylinders is presented. The objective is to contribute to the research on the combined flow field close to vortex breakdown conditions. The two swirling water streams are interacting in the extension of the outer cylinder. Swirl is generated by two rotating impellers, located in the inner tube and the annular duct, just before the merging of the two streams. Controlled flow parameters comprise the flow rates of the streams and the angular velocities of the impellers. The flow field is monitored by means of Stereoscopic 3D-PIV, providing the velocity components on an axial, central plane. Four typical test cases were investigated comprising four combinations of inlet conditions. Two dimensionless numbers were utilized to interpret the experimental results, a modified Rossby number and the velocity ratio ζ, along with the Reynolds numbers of the internal and annular stream, respectively. The most important coherent structure developed, is a recirculation region formed downstream of the exit of the internal swirl nozzle. A bubble type vortex breakdown occurs when the appropriate flow conditions are applied. The alterations of the flow field were discussed with respect to the changes of the inlet conditions. The flowrates of the two streams and the combined swirl strength applied through the rotating impellers appear to be crucial for the onset of the vortex breakdown. Comparisons were drawn with previous work.

J09. E. Sarmas, N. Dimitropoulos, S. Strompolas, Z. Mylona, V. Marinakis, **A. Giannadakis**, A. Romaios, H. Doukas, 2022, A web-based Building Automation and Control Service, 13th International Conference on Information, Intelligence, Systems and Applications (IISA2022), 18–20 July 2022, Corfu, Greece.

The reduction of the environmental impact in the building sector is necessary in achieving global sustainability. In this context, Building Automation and Control systems provide the opportunity for efficient monitoring and control facilities' subsystems, such as the heating and cooling system, the ventilation system, the hot water system, the lighting appliances among others, with the goal of improving thermal comfort as well as energy efficiency. This paper presents a Building Automation and Control system aiming at facilitating data-driven monitoring of complex, multi-storey facilities, by disagreggating total consumption of the different floors and rooms of the building and offering advanced insights and benchmarking indicators. The service is showcased with a use case application on a real building, where the benefits of the service for the energy manager are highlighted.

J10. Wang, S., Zhou, Z., Chen, B., & Thrassos, P., Romeos, A., **Giannadakis, A.**, (2023). Dynamic thermal management of flashing spray cooling by the frequency conversion of the compressor. *Applied Thermal Engineering*, Vol.218, 119322

Dynamic thermal management of electronic equipment is of practical importance to adapt to the quickly changed heat load at local spot. A closed-loop experimental system was constructed to study the heat transfer mechanism and cooling performance of flashing spray cooling by R410A on a smooth flat copper surface in steady-state and varying operating conditions, especially the effect of frequency conversion of compressor. The results indicated that the superheat of 4 ℃ and 22 ℃ can be regarded as the transition points between three heat transfer stages of steady R410A flashing spray cooling: single-phase heat transfer, nucleate boiling, and transition boiling. To achieve the best cooling performance, superheat should be between 4 ℃ and 22 ℃ to keep heat transfer in stage II. The increase of compressor frequency can improve the cooling performance of spray system effectively. When the compressor frequencies are 10 Hz, 15 Hz and 20 Hz, CHF can reach 162.9, 168.3 and 175.0 W/cm^2, and the maximum heat transfer coefficient is around 60.5, 80.6, and 90.4 kW/(m^2·K), separately, with surface temperature below 35 ℃, 30 ℃ and 25 ℃. At the same heat flux, the power consumptions for the system to reach steady-state at 15 Hz and 20 Hz are 12.2% lower but 5.9% higher than that at 10 Hz, which provides a feasible energy-saving strategy for spray cooling system in the practical thermal management of electronic equipment.

J11 Yin, J., Wang, S., Sang, X., Zhou, Z., Chen, B., Thrassos, P., Romeos, A., **Giannadakis, A**. (2022). Spray Cooling as a High-Efficient Thermal Management Solution: A Review. 1–29.

As one of the most promising thermal management solutions, spray cooling has the advantages of high heat-transfer coefficient and maintaining a low temperature of the cooling surface. By summarizing the

influential factors and practical applications of spray cooling, the current challenges and bottlenecks were indicated so as to prompt its potential applications in the future. Firstly, this paper reviewed the heat-transfer mechanism of spray cooling and found that spray cooling is more advantageous for heat dissipation in high-power electronic devices by comparing it with other cooling techniques. Secondly, the latest experimental studies on spray cooling were reviewed in detail, especially the effects of spray parameters, types of working fluid, surface modification, and environmental parameters on the performance of cooling system. Afterwards, the configuration and design of the spray cooling system, as well as its applications in the actual industry (data centers, hybrid electric vehicles, and so on) were enumerated and summarized. Finally, the scientific challenges and technical bottlenecks encountered in the theoretical research and industrial application of spray cooling technology were discussed, and the direction of future efforts were reasonably speculated

J12. Wang, J., Zhou, Z., Chen, B., Yang, T., Zhang, L., Romeos, A., **Giannadakis, A.**, Panidis, T. (2023). Flow visualization of the transient effect of the internal two-phase flow on the external iso-pentane flashing spray under different injection pressure. Fuel, 333(P1), 126151. https://doi.org/10.1016/j.fuel.2022.126151

Flashing spray occurs when the saturated liquid is discharged into a gaseous environment at an ambient pressure lower than its saturation pressure. Internal flow is a primary determinant on the behavior of external flashing spray, so its transient effect was investigated with iso-pentane as working medium. The coupled effect of superheat level and injection pressure was comprehensively explored with initial temperature from 30 °C to 70 °C and injection pressure from 1.2 MPa to 2.4 MPa. Under different injection pressure, the stable spray patterns can still be categorized as non-shattering, partially shattering, completely shattering and flare flashing separated by the shattering index X·(Pinj/Pa)0.5 of 0.21, 0.39 and 0.76, which represents the product of homogeneous nucleation rate and the ratio of injection pressure over ambient pressure. A strong correlation between the spray cone angle and the shattering index is proposed as a piecewise function separated by X·(Pinj/Pa)0.5 = 0.39. High-void-fraction internal two-phase flow is easier to be formed in partially shattering or completely shattering pattern, which would lead to a hysteretic flashing spray with a significant increase of spray cone angle and droplets concentration. Low X·(Pinj/Pa)0.5 yields slower response of external morphological changes but larger enhancement of radial expansion.

J13. Parissis, P., Romeos, A., **Giannadakis, A**., Kalarakis, A., & Peroulis, M. (2023). Computational Study of Hemodynamic Field of an Occluded Artery Model with Anastomosis. Bioengineering, 10(2). https://doi.org/10.3390/bioengineering10020146

In this research work, the hemodynamic field of an occluded artery with anastomosis by means of computational simulation has been studied. The main objective of the current study is the investigation of 3D flow field phenomena in the by-pass region and the effect of the bypass graft to stenosis volume flow ratio on their formation. The anastomosis type was end-to-side with a 45° angle, while stenosis imposed a 75% area blockage of the aorta vessel and the total volume flow was 220 lt/h. The computational study of the flow field was utilized via a laminar flow model and three turbulence models (k—ε RNG, standard k—ω, and k—ω SST). Numerical results were compared qualitatively with experimental visualizations carried out under four different flow conditions, varying according to the flow ratio between the stenosis and the anastomotic graft. Comparison between computational results and experimental visualization findings exhibited a good agreement. Results showed that SST k—ω turbulence models reproduce better visually obtained flow patterns. Furthermore, cross-sectional velocity distributions demonstrated two distinct flow patterns down the bypass graft, depending on the flow ratio. Low values of flow ratio are characterized by fluid rolling up, whereas for high values fluid volume twisting was observed. Finally, areas with low wall shear stresses were mapped, as these are more prone to postoperative degradation of the bypass graft due to the development of subendothelial hyperplasia.

J14. Wang, S., Zhou, Z., Sang, Z., Chen, B., & Thrassos, P., Romeos, A., **Giannadakis, A.**, (2023). Coupling dynamic thermal analysis and surface modification to enhance heat dissipation of R410A spray cooling for high-power electronics, Energy, Vol. 284

With high critical heat flux (CHF) and heat transfer coefficient (HTC), spray cooling is considered as one of the most promising thermal management technologies for high-power electronic devices. To increase its cooling performance, a closed-loop experimental rig was constructed to study the effects of spray and system parameters on heat transfer enhancement by R410A. The best cooling performance can be achieved under optimal subcooling degree of 17 ◦C and nozzle diameter of 0.56 mm. When the compressor frequency reaches the upper limit of 90 Hz, maximum CHF and HTC on flat surface are 301.6 W/cm2 and 91.7 kW/(m^2·K). To further improve CHF, mechanism of heat transfer enhancement by square pin finned surface was revealed in terms of droplet splashing. With fin width of 0.5 mm and height of 3 mm, CHF as high as 522.1 W/cm2 and peak HTC of 407.0 kW/(m^2·K) are reached, while maintaining the cooling surface temperature lower than 55.6 ◦C. Compared to flat surface, CHF and HTC are enhanced by around 73.4% and 3.5 times, respectively. Based on the experimental data, CHF correlation applicable to pin finned surface was obtained with precision of ±12.4% by introducing fin height and width.

J15. Papadogianni, V.N., Romeos, A., **Giannadakis, A.,** Perrakis, K., Panidis, T., (2023), Fire Ignition and Propagation in Hidden Zones of Aircrafts: A Novel Confined Fire Apparatus (CFA) for Flame Spreading Investigation, Fire, 6(8), 292

This research investigated potential fire hazards originating in hidden areas of pressurized sections of aircrafts. The objective was to establish a laboratory-scale flammability test method to predict the behavior of fire propagation under real fire conditions. A confined fire apparatus (CFA) was designed and constructed, and several tests were conducted to better understand the involved mechanisms and their consequences and to estimate flame spreading in hidden-zone fires. The experimental facility and flame-spreading results obtained for a typical material involved in hidden fires, specifically a ceiling panel, were presented and discussed. The experimental facility consisted of a narrow passage where a fire was initiated using a burner on a specimen exposed to a controlled heat flux. Experiments were conducted in the absence of forced airflow. Flame spreading was estimated through visual monitoring of fire development or temperature measurements at specific locations in the specimen. Both methods yielded similar results. The flame spread velocity in relation to the imposed heat flux allowed for the estimation of the critical heat flux for spreading and for ignition, the corresponding temperatures, $T_{s,min}$ and T_{ig}; and the flame spread parameter Φ.

J16. **A. Giannadakis,** A. Romeos, I. Kalogirou, Dimitris I. Dimopoulos, Georgios., P. Trachanas, V. Marinakis & G. Mihalakakou (2025) Energy performance analysis of a passive house building, Energy Sources, Part B: Economics, Planning, and Policy, 20:1, 2455114, DOI:10.1080/15567249.2025.2455114

Nearly Zero Emission Buildings' construction is one of the leading-edge European Union directives concerning the decarbonization of the building sector and the stimulation of energy transition in the construction sector. Therefore, improvements made regarding Nearly Zero Emission Buildings' energy efficiency are of high importance to achieve their evolution to Positive Energy Buildings, i.e buildings producing more energy than they consume. In this study, we present insights from a detailed energy audit of a passive house based on measured energy data. Data captured from a wide sensor grid (ambient and internal temperature, CO2 emissions, humidity sensors, electrical energy meters, etc.), constituting the dwelling's building control system, are analyzed and statistically processed in order to evaluate building's energy efficiency. Through a detailed analysis of the building's real-time energy balance, the construction of energy consumption baselines and the evaluation of energy saving potential that arises, new benchmark data are produced that may improve Nearly Zero Emission Buildings design and modeling, and Building Energy Modelling (BEM) and Building Information Modeling (BIM) in general. The conducted analysis showcased the remarkable energy performance and comfort of the interior of the dwelling which, in cases, are even better than that of the design indicators. More precisely, the average specific annual energy consumption for heating is 7.18 kWh/m2 a, whereas the specific annual energy consumption for cooling is calculated to 7.34 kWh/m2 a, much less than the design indicator.

J17. Paravantis J.A., Malefaki S., Nikolakopoulos P., Romeos A., **Giannadakis A**., Giannakopoulos E., Mihalakakou G., Souliotis M., (2025). Statistical and machine learning approaches for energy efficient buildings Energy and Buildings, 330, 115309

Buildings are responsible for nearly 40% of primary energy consumption. Over the recent decades, numerous methods have been proposed to model, predict, and optimize the heating and cooling energy consumption in buildings, prioritizing efficiency, accuracy, simplicity, and speed. From basic deterministic formulations to advanced machine learning techniques, various methods have been proposed to improve the thermal performance of existing structures and optimize the design of new ones. This manuscript reviews statistical and machine learning approaches in building energy performance simulation, presenting and discussing theoretical considerations and a review of published research studies, covering input, output, distinctive modeling features, and main results. Statistical learning techniques include linear prediction models, generalized linear models, linear mixed-effects models, Bayesian approaches, and time series analysis. Machine learning techniques include deep learning approaches, such as deep feed-forward, recurrent, and convolutional artificial neural networks. Support-vector machines and ensemble machine learning are also discussed, each with a review of relevant research studies, respectively. The application of machine learning approaches in building design and control include both model predictive and reinforcement learning-based control, and building retrofit. The goal is to provide a detailed overview of historical and contemporary developments in data-driven methodologies, encompassing various scientific approaches and algorithms shedding light on the complexities and trends in the dynamic field of energy-efficient building design and operation.

J18. Kotsopoulos D., Parissis P., **Giannadakis A.**, Perrakis K., Mihalakakou G., Panidis T., Chen B., Zhou Z., Romaios A., 2025, Experimental Investigation of Flash Spray Cooling for Power Electronics, Journal of Thermal Management, Energies, 18(17), 4484

Power electronics convert and control electrical power in applications ranging from electric motors to telecommunications and computing. Ongoing efforts to miniaturize these systems and boost power density demand advanced thermal management solutions to maintain optimal cooling and temperature control. Spray cooling offers an effective means of removing high heat fluxes and keeping power electronics within safe operating temperatures. This study presents an experimental investigation of flash spray cooling in a closed-loop system using R410A refrigerant. In particular, two nozzles with different spraying angles are used to study the effects of the distance between the spray nozzle and a heated flat surface, as well as the mass flow rate of the coolant. Results indicate that three key flow-pattern factors—surface coverage, impingement intensity, and liquid film dynamics—govern the heat-transfer mechanisms and determine cooling efficiency. Flash spray cooling using refrigerants like R410A demonstrates strong potential as a high-performance thermal management strategy for next-generation power electronics.

J21. Mihalakakou G, **Giannadakis A.,** Malefaki S., Souliotis M., Georgiou P., Romaios A., Antzoulatou A, Nikolakopoulos P., Paravantis J.A., (2025)**,** Coupling simulation-based and machine learning methodologies for energy optimization and enviromental impact mitigation in buildings, Journal of Building Engineering, 112, 113809

Buildings account for approximately 40% of global carbon dioxide emissions, making their efficient operation essential for addressing climate change. The optimization of energy consumption in buildings is crucial for reducing operational costs, mitigating environmental impacts, and enhancing sustainability. Optimization techniques, including multi-objective optimization, enable decision-makers to balance trade-offs between energy efficiency, occupant comfort, and economic feasibility. This study classifies optimization methodologies into exact and heuristic approaches, detailing mathematical programming, evolutionary algorithms, and metaheuristic techniques such as genetic algorithms, particle swarm optimization, and simulated annealing. Special attention is given to multi-objective optimization, where conflicting goals, such as thermal comfort vs. energy savings, require Pareto-efficient solutions. Machine learning further enhances energy optimization by predicting energy demand and refining decision-making through supervised, unsupervised, and reinforcement learning models. Surrogate modeling, leveraging artificial neural networks and support vector machines, accelerates optimization by reducing computational complexity. Through an

in-depth evaluation of simulation techniques and real-world case studies, this study illustrates how these methods can achieve notable energy savings. Additionally, this study highlights the strengths of machine learning models for their precision and effectiveness in optimizing complex energy systems. Despite persistent challenges like data scarcity, regulatory barriers, and inconsistent subsidy structures, aligning optimization practices with sustainability targets provides a viable path toward large-scale decarbonization and strengthened economic resilience. By combining advanced computational models with data-driven techniques, this review study underscores the transformative potential of artificial intelligence and optimization in shaping the future of energy-efficient, sustainable building design and operation.

J22. Makris D., Romaios A., Malefaki S., Paravantis J.A., **Giannadakis A.,** Mihalakakou G, (2025)**,** Optimizing Energy and Cost Performance in Residential Buildings: A Multi-Objective Approach Applied to the City of Patras, Greece, Energies, 18(13), 3361

Improving the energy efficiency of buildings is a critical pathway for mitigating greenhouse gas emissions and fostering sustainable urban development. This study introduces a simulation-based multi-objective optimization framework designed to enhance both the thermal and economic performance of residential buildings. A representative single-family dwelling located in Patras, Greece, served as a case study to demonstrate the application and scalability of the proposed methodology. The optimization simultaneously minimized two conflicting objectives: the building's annual thermal energy demand and the cost of construction materials. The computational process was implemented using MATLAB's Multi-Objective Genetic Algorithm, supported by a modular Excel interface that enables dynamic customization of design parameters and climatic inputs. A parametric analysis across four optimization scenarios was conducted by systematically varying the key algorithmic hyperparameters—population size, mutation rate, and number of generations—to assess their impact on convergence behavior, Pareto front resolution, and solution diversity. The results confirmed the algorithm's robustness in producing technically feasible and non-dominated solutions, while also highlighting the sensitivity of optimization outcomes to hyperparameter tuning. The proposed framework is a flexible, reproducible, and computationally tractable approach for supporting early-stage, performance-driven building design under realistic constraints.

J23. Kalogirou, I.D.; Romeos, A.; **Giannadakis, A*.**; Mihalakakou, G.; Panidis, T., 2025**,** Vortex Dynamics Effects on the Development of a Confined Turbulent Wake. *Fluids*, *10*, 283.

In the present work, the turbulent wake of a circular cylinder in a confined flow environment at a blockage ratio of 14% is experimentally investigated in a wind tunnel consisting of a parallel test section followed by a constant-area distorting duct, under subcritical Re inlet conditions. The initial stage of wake development, extending from the bluff body to the end of the parallel section, is analyzed, with the use of hot-wire anemometry and laser-sheet visualization. The near field reveals partial similarity to unbounded wakes, with the principal difference being a modification of the Karman vortex street topology, attributed to altered vortex dynamics under confinement. Further downstream, the mean and fluctuating velocity distributions of the confined wake gradually evolve toward channel-flow characteristics. To elucidate this transition, wake measurements are systematically compared with channel flow data obtained in the same configuration under identical inlet conditions and with reference channel-flow datasets from the literature. Experimental results show that a vortex transportation mechanism exists due to confinement effect, resulting in the progressive crossing and realignment of counter-rotating vortices toward the tunnel centerline. Although wake flow characteristics are preserved, suppression of classical periodic shedding is clearly depicted. Furthermore, it is shown that the confined near-wake spectral peak persists up to x1/d~60 as in the free case and then vanishes as the spectra broadens. Coincidentally, the confined wake exhibits a narrower halfwidth than its free wake counterpart, while a centerline shift of the shed vortices is observed. Farfield wake-flow maintains strong anisotropy, while a weaker downstream growth of the streamwise integral scale is observed when compared to channel flow. Together, these findings explain how confinement reforms the nearfield topology and reorganizes momentum transport as the flow evolves to channel-like flow.

J24. Romaios, A. , Sfikas, P., **Giannadakis, A.,** Panidis, T., Paravantis J.A., Skouras, E.D., Mihalakakou, G., 2025, Artificial Intelligence for Enhancing Indoor Air Quality in Educational Environments: A Review and Future Perspectives, Sustainability, 2025, 17(22), 10117

Indoor Air Quality (IAQ) in educational environments is a critical determinant of students' health, well-being, and learning performance, with inadequate ventilation and pollutant accumulation consistently associated with respiratory symptoms, fatigue, and impaired cognitive outcomes. Conventional monitoring approaches—based on periodic inspections or subjective perception—provide only fragmented insights and often underestimate exposure risks. Artificial intelligence (AI) offers a transformative framework to overcome these limitations through sensor calibration, anomaly detection, pollutant forecasting, and the adaptive control of ventilation systems. This review critically synthesizes the state of AI applications for IAQ management in educational environments, drawing on twenty real-world case studies from North America, Europe, Asia, and Oceania. The evidence highlights methodological innovations ranging from decision tree models integrated into large-scale sensor networks in Boston to hybrid deep learning architectures in New Zealand, and regression-based calibration techniques applied in Greece. Collectively, these studies demonstrate that AI can substantially improve predictive accuracy, reduce pollutant exposure, and enable proactive, data-driven ventilation management. At the same time, cross-case comparisons reveal systemic challenges—including sensor reliability and calibration drift, high installation and maintenance costs, limited interoperability with legacy building management systems, and enduring concerns over privacy and trust. Addressing these barriers will be essential for moving beyond localized pilots. The review concludes that AI holds transformative potential to shift school IAQ management from reactive practices toward continuous, adaptive, and health-oriented strategies. Realizing this potential will require transparent, equitable, and cost-effective deployment, positioning AI not only as a technological solution but also as a public health and educational priority.

Proceedings of International Conferences

C01. Vouros A., **Giannadakis A.**, & Panidis Th., 2003, Round Jets Pairing, Third Meeting of Greek Section of the Combustion Institute, P2, pp. 1-8.

The present work is part of ongoing research on turbulent mixing characteristics of the interaction of a weak and a strong jet. The study aims to provide a better insight to the basic features of the interaction and exploit the capabilities of this configuration in staged combustion systems. Detailed experimental investigations along with numerical predictions are used. In this paper, the velocity field of the primary round turbulent jet, issuing vertically inside cavities with open roof, is predicted using a numerical code. Mean flow characteristics, such as the axial development and the radial profiles of the velocity field, are presented. Two different types of cavities are used in order to evaluate confinement effects and comparisons with previous measurements in free jets are attempted. The influence of the reverse flow on jets momentum loss appears to be considerable for each case of confinement. Finally, numerical predictions of jets interaction are presented. The effect of a secondary jet issuing within the narrower cavity is studied. The flow field produced by the jets merging approaches that of free jets 70 diameters from the jet exit.

C02. **Giannadakis A.**, Vouros A., Perrakis K., & Panidis Th., 2003, Confined Coaxial Swirl Flow, Third Meeting of Greek Section of the Combustion Institute, P4, pp. 1-8

Swirling flows are widely used in combustion systems. They constitute a distinct case of complex flows. The essential features of swirling flows in combustion systems are the control of a recirculation zone acting as a flame stabilizer along with the enhancement in mixing and ambient fluid entrainment. The present work is part of ongoing research involving the experimental and computational investigation of swirl phenomena and their application to combustion systems. In this paper, a confined co-axial flow is studied with the use of a commercial CFD code. An outer parallel flow is used to control the flow characteristics of an inner swirling jet (stream wise vortex). Swirl is produced by means of tangential injection. Temperature is used as a passive scalar in order to study entrainment and diffusion effects. Predicted profiles of mean temperature, axial and tangential velocities show that the Reynolds number of the parallel flow can play a dominant role on the persistence of the inner jet swirl strength and the flow field's tendency to form recirculation zones. It is shown that the existence of parallel flow can delay the diffusion of angular momentum, due to mixing, by creating a smoother pressure field.

C03. **Giannadakis, A.**, Romeos, A., Vouros, A., Perrakis, K. & Panidis, Th., 2004, Experimental Investigation of Confined Coaxial Swirl Flow, Joint Meeting of the Greek and Italian Sections of The Combustion Institute, Corfu, P24, pp 1-6

Swirling flows are widely used in combustion chambers and furnaces, due to their effect on flame stabilization, mixing improvement and the reduction of pollutant emissions. In the present work, the isothermal flow field of a coaxial combustor is being studied. Particularly, the influence of the mass flow ratio between the outer (annular) flow and the inner (swirling) jet on the flow characteristics is being investigated. Swirl is produced by means of tangential injection. The swirling jet is introduced into the combustion chamber through a slightly conical nozzle, while a centrifugal fan supplies the annular flow. X-probe HWA measurements of the mean and turbulent flow field are presented for several distances downstream in the combustor. It is shown that variation of the mass flow ratio strongly affects the structure of the shear layer as well as the decay of the jet's swirl strength.

C04. Vouros A., **Giannadakis A**., Panidis Th., 2004, Experimental Evaluation of a Basic Staged Combustion Configuration, Joint Meeting of the Greek and Italian Sections of The Combustion Institute, Corfu, 17-19 June, P25, pp 1-6.

The effect of a secondary "weak" jet on a "strong" jet's flow field is of great importance for the evaluation

of many staged combustion schemes. The present work is part of ongoing research on turbulent mixing characteristics of the interaction of a weak and a strong jet inside a confining area, with experimental and numerical tools. Preliminary experimental results, obtained with laser Doppler anemometry, will be presented. Measurements of mean and turbulent velocity statistics of a single turbulent axisymmetric jet are presented for reference. At a distance of thirty strong jet's diameters, mean and rms velocity profiles of jets' merging are presented for isothermal conditions. In this test case momentum flux ratio of jets is rather high. Two local maximums corresponding to the central region of each jet are identified. A slight displacement of weak jet's maximum and a small increase of turbulent components at the edges of jets indicate early stages of mixing.

C05. Giannadakis A., Perrakis K., Romeos A., Panidis Th., 2007, Characteristics of Recirculating Swirl Flows, Third European Combustion Meeting, Mediterranean Agronomic Institute Of Chania Crete, Greece 11-13 April

The isothermal recirculating flow field generated by a swirling jet and a coaxial annular flow entering a pipe is investigated with the use of 2D-DPIV. Parametric change of flow inlet conditions (constant tangential injection with change of annular velocity and vice versa) is being considered in order to study the effect of the coaxial flow field on the recirculation bubble structure. Measurements of the mean and turbulent flow field are discussed in terms of bubble topology and dynamics from an aspect of a modified Rossby number. It is shown that the vortex ring structure plays an important role both on the recirculating features of the flow and the mixing processes between the swirling jet and the annular flow.

C6. A. Cavo, **A. Giannadakis**, K. Perrakis, Th. Panidis., 2010, Experimental Investigation of the Structural Development in the Near Field of a Rectangular Turbulent Jet using DPIV and HWA, 2010, Euromech Fluid Mechanics Conference – 8

The structural development of a rectangular turbulent jet of aspect ratio 6 in the near field region has been investigated experimentally using 2D Digital Particle Image Velocimetry (DPIV) and X-wire Hot Wire Anemometry (HWA). Measurements have been conducted for Reynolds number ReD=21000 at distances from the nozzle up to x/D=12, where D is the width of the nozzle. Presented measurements of mean velocity and vorticity and the corresponding turbulent terms indicate a good convergence of the results of the two techniques justifying their use to obtain complementary aspects and perspectives of the flow field. Presented results provide information regarding the large scale structure's topology, origin, evolution, mutual interaction and role in the near flow field of the rectangular turbulent jet.

C07. Giannadakis A., Panidis T., Romeos A., Perrakis K., 2010, Mixing characteristics of a coaxial swirling jet: An experimental study, ETMM8: 8th International ERCOFTAC Symposium on Engineering Turbulence Modelling and Measurements, 9 – 11 June 2010, Marseille, France

A 2D DPIV study of a coaxial flow with inner swirl is presented in this work. An inner swirling jet, produced by tangential injection, interacts with an annular flow generating a recirculating flow field with strong mixing attributes. The characteristics of the cross plane velocity components of four different test cases are presented (two levels of tangential injection flow rate combined with two levels of annular flow rate) in order to study the mean and turbulent attributes of the swirling vortex. The main features of this complex flow field, which can be considered as the interaction of a typical swirling jet undergoing "vortex breakdown" with an outer annular flow with "backward facing step flow" characteristics, are investigated, focusing on the swirling jet's characteristics. The analysis of the mean and turbulent flow is based on a modified Rossby number, recently proposed by the authors, which is the ratio of the streamwise velocity jump across the two streams over a typical tangential velocity, which is shown to represent the ratio of the pressure difference due to the streamwise velocity difference and the entrainment of the two flows to that due to the rotation of the swirling vortex.

C08 S. Caneva, I. Weiss, W. Hieg, R. Janssen, D. Rutz, P. Helm, W. Kirchensteiner, M. Wolf, E. Schellekens, D. Campogrande, I. Nedelcheva, M. Papež, S. Stelepis, Y. Magiera, Y. Nemish, M. Esitini, M. Merrone Stavros A. Pressas, **T. Giannadakis,** 2010, European Project "Install+RES": Training Courses for Trainers and Installers of Small Scale Renewable Energy Systems, 25th European Photovoltaic Solar Energy Conference - 5th World Conference on Photovoltaic Energy Conversion in Valencia, Spain, on Wednesday 8 September.

The quality and quantity of installed renewable energy systems should get improved and enlarged by education and training means in order to reach the 20-20-20 targets set in the European Energy and Climate Change package: reducing greenhouse gas emission by 20%, increasing the share of renewable in energy consumption to 20% compared to 8.5% today and improving energy efficiency by 20%, all by 2020. The qualification of trainers and installers is determining the quality of the installed Renewable Energy Systems (RES). This paper focuses on the first European training course for trainers and installers (electricians, plumbers, roofers and technicians for heating systems) of small-scale renewable energy systems (heat pumps, biomass, solar and photovoltaic systems) in buildings offered within the European project "Install+RES". The Install+RES training courses will be developed and established in several European countries (Bulgaria, Greece, Italy, Poland and Slovenia) in line with the requirements stated in the Directive 2009/28/EC on the promotion of the use of energy from renewable energy sources (article 14, Annex IV). The Install+RES training courses are meant to be an investment for sustainability by evolutionary processes, which will lead to the establishment of a high quality of skills and as consequence to the maximization of Renewable Energy Systems (RES)´s efficiency, reliability, lifetime and safety. The Install+RES training courses are based on a well balanced relationship between theory and practice. The training courses will mainly take place in demonstration facilities and laboratories, where practical work is performed. The Install+RES project started in May 2010 and will end in April 2013. The Install+RES project is co-financed by the European Commission in the framework of the Intelligent Energy Europe (IEE) program.

C09. I. Weiss, S. Arancon, W. Hieg, R. Janssen, D. Rutz, P. Helm, W. Kirchensteiner, M. Wolf, E. Schellekens, D. Campogrande, I. Nedelcheva, M. Papež, S. Stelepis, Y. Magiera, Y. Nemish, M. Esitini, M. Merrone Stavros A. Pressas, **T. Giannadakis**, 2011, How to ensure quality in the installation of small scale Renewable Energy Systems in Buildings: The Install+RES " Train the Trainer" Courses, 26th European Photovoltaic Solar Energy Conference and Exhibition, Hamburg, Germany, 5 – 9 September.

The Directive 2009/28/EC on the promotion of the use of energy from renewable energy sources sets an overall binding target of a 20% share of renewable energy sources in energy consumption by 2020 with binding national targets in line with the overall EU target of 20%. Details of how these targets will be achieved in each Member State are given in National Renewable Energy Action Plans (NREAPs). High qualified workforce is fundamental to guarantee the quality in the installation of Renewable Energy Systems (RES) to be installed to achieve the mandatory targets of the National Renewable Energy Action Plans (NREAPs) by 2020. This paper presents the first European training course for trainers (teachers and engineers) and installers (electricians, plumbers, roofers and technicians for heating systems) of small-scale renewable energy systems (heat pumps, biomass, solar and photovoltaic systems) in buildings offered within the European project "Install+RES". The paper focuses on the "train the trainer" courses offered during the Install+RES project highlighting the innovative aspects of the "hand on learning" concept, "tandem teaching" approach and the "multiplier effect". The Install+RES training courses are meant to be an investment for sustainability by evolutionary processes, which will lead to the establishment of a high quality of skills and as consequence to the maximization of Renewable Energy Systems (RES)´s efficiency, reliability, lifetime and safety and therefore to achieve the mandatory targets stated in the National Renewable Energy Action Plans (NREAPs). The Install+RES project started in May 2010 and will end in April 2013. The Install+RES project is co-financed by the European Commission in the framework of the Intelligent Energy Europe (IEE) program.

C10. I. Weiss, S. Arancon, W. Hieg, R. Janssen, D. Rutz, P. Helm, W. Kirchensteiner, M. Wolf, E. Schellekens, D. Campogrande, I. Nedelcheva, M. Papež, S. Stelepis, Y. Magiera, Y. Nemish, M. Esitini, M. Merrone Stavros A. Pressas, **T. Giannadakis**, How to provide qualified installers of small scale Renewable Energy Systems in Buildings: The Install+RES Training Courses 2012, 27th European Photovoltaic Solar Energy Conference and Exhibition, Frankfurt, Germany, 24 – 28 September

This paper presents the first European training course for trainers and installers of small-scale renewable energy systems in buildings offered within the European project “Install+RES”. The Install+RES training courses are meant to be an investment for sustainability by evolutionary processes, which will lead to the establishment of a high quality of skills and as consequence to the maximization of Renewable Energy Systems (RES)´s efficiency, reliability, lifetime and safety. The Install+RES project started in May 2010 and will end in April 2013. The Install+RES project is co-financed by the European Commission in the framework of the Intelligent Energy Europe (IEE) Program.

C11. Alexandros Romeos, Alexandros Vouros, **Athanasios Giannadakis**, Vicky Papadogianni, Kostas Perrakis, Thrassos Panidis, 2013, ´´Assessment of Fire Behavior of Materials´´, 8th World Conference on Experimental Heat Transfer, Fluid Mechanics, and Thermodynamics June 16-20, Lisbon, Portugal.

This paper presents experimental and numerical data of PMMA burning during Cone Calorimeter tests. Several external heat fluxes have been imposed experimentally, from 10 to 50 KW/m^2. 40 and 50 KW/m^2 external heat fluxes have been used for the numerical simulations. The latter were based on the solution velocity and temperature fields in a three-dimensional domain, by taking into account the exact cone geometry and realistic boundary conditions. Time series of Heat Release Rates (HRR) and Mass Loss Rates (MLR) are presented, while experimental data are furthermore used to estimate thermal properties of the specimen, including Critical Heat Flux and Heat of Gasification. Comparisons between experimental and numerical data indicate under and over predictions of HRR and MLR respectively, but also fine agreement regarding the trends of the produced curves and the total time of PMMA burning.

C12. Romeos A., **Giannadakis A.**, Perrakis K., Panidis Th., 2014, ´´Co-rotating Vortex Interaction´´, 4th EASN Association International Workshop on Flight Physics & Aircraft Design, 27th-29th October, Aachen, Germany

The structure and dynamic development of a pair of co-rotating vortices during their formation, interaction and merging is studied using detailed measurements of the velocity and vorticity fields. The vortex wake is a phenomenon of interest in many scientific fields, including aeronautics, fluid mechanics and air transportation management. This phenomenon has been rendered particularly important during the last decades, due to increasing traffic density of very heavy aircraft and several plane “in cidents”, which were attributed to the action of the vortex wake. The vortices were generated using two half wings (NACA0030) positioned at equal and opposite angles of attack at the entrance of the test section of an open-circuit, subsonic, wind tunnel. Velocity vector measurements were obtained, at Rec=133000, on cross plane grids at several locations from the trailing edges of the wings, using an in-house developed 4-sensor hot wire anemometer probe. The results include cross plane contour plots of the mean and fluctuating velocity as well as mean vorticity fields. Each of these variables is affected in a different way providing complementary information on the development of the flow field.

The results indicate that after shedding the two vortices are swept along the streamwise direction and spiral around each other thereby developing a braid of two vortices , which then deforms the external flow field. Gradually the interaction with the external flow field links both vortices together until the final merging and the formation of a new stable linear vortex emerges.

C13. Romeos A., **Giannadakis A.,** Kalogirou I., Perrakis K., Panidis Th., 2015, "Visualization study of an occluded artery with an end-to-side anastomosis", INASE, 19th International Conference on Circuits, Systems, Communications and Computers – Continuum Mechanics, Zakynthos Island Greece, July 16-20.

The hemodynamic field of an occluded artery with an „end to side" anastomosis is studied experimentally. The influence of a distal end to side anastomosis to the formation of vortical structures and flow field evolution are discussed, via a visualisation approach, as a function of Reynolds number. In this manuscript both the steady and pulsatile flow cases are considered. Qualitative results show the influence of the inlet flow conditions (Reynolds and Womersley number) on the formation of vortical structures and the rearrangement of the hemodynamic field downstream the anastomosis.

C14. A. Naxakis, A. Romeos, **A. Giannadakis**, T. Panidis, 2021, Experimental Study on Coaxial Swirling Jets, 9th International Conference on Vortex Flow Mechanics - ICVFM2021, Virtual Conference, October 11-14,2021

Experimental results on coaxial swirling flows are presented, aiming to contribute to the investigation and understanding of vortical flows close to vortex breakdown conditions, following the works of Giannadakis et al 2008 and Naxakis et al 2018. Two swirling jets are issuing from parallel coaxial straight tubes of two sizes in a coaxial cylinder of diameter equal to the largest tube. Swirl is introduced by two rotating vanes located close to the outlets of both jets respectively. Initial conditions, flow rates and swirling strengths can be parametrically controlled. The mean flow fields are monitored on the axial central plane, based on measurements of all three velocity components, using Stereoscopic PIV. Refractive index matching is utilized to eliminate optical distortions. In the present experiments three inner and six annular flow rates were combined with four inner jet and three annular jet swirls comprising a relatively large number of inlet conditions.

C15. D. Voultsou, A. Romeos, A. Kalarakis, **A. Giannadakis**, 2021, Numerical Investigation of a Backward Facing Step Flow Controlled by a Synthetic Jet, 9th International Conference on Vortex Flow Mechanics - ICVFM2021, Virtual Conference, October 11-14,2021

In the present work, the flow over a backward-facing step with the presence of a synthetic jet is studied using a 2D CFD model. The geometry under investigation can be found in numerous engineering applications in aeronautics and industry such as heat exchangers, nuclear reactors, diffusers, air conditioning systems. This study focus on recirculating flows detaching and reattaching to the main flow. Knowledge of the conditions under which these phenomena are observed helps in the development of flow control technologies and thus minimize flow disturbance, and kinetic energy losses.

C17. Papadogianni V., Romeos A., **Giannadakis A**., Perrakis K., Panidis T., 2022, Flame Spreading in Confined Spaces, 12th Mediterranean Combustion Symposium, Luxor, Egypt, January 23-26, 2023

This research investigates the potential fire hazard of fire originating in hidden (inaccessible) areas of the pressurized section of aircrafts. The objective was to establish a laboratory scale flammability test method to predict fire propagation behavior under real fire conditions. To this end a Confined Fire Apparatus (CFA) was designed and constructed, and a number of tests were performed in order to promote a better identification of the involved mechanisms, their consequences, and the estimation of flame spreading in hidden zone fires. In this work the experimental facility and flame spreading results obtained for a typical material involved in hidden fires, namely a ceiling panel, are presented and discussed. The experimental facility consists of a narrow passage in which a fire is initiated using a burner on a specimen exposed to a controlled heat flux. Experiments were performed in the absence of a forced flow. Flame spreading was estimated either by visual monitoring of the development of fire or by temperature measurements at certain locations in the specimen. Both methods provided similar results.

C18. **A. Giannadakis**, A. Romeos, I. Kalogirou, D. Dimopoulos, V. Marinakis, H. Doukas, 2022, Insights from a Detailed Energy Audit of a Passive House Building, INTERNATIONAL BUILDING DECARBONIZATION 2022 CONFERENCEASHRAE Hellenic Chapter, 6-7 October 2022

Nearly Zero Emission Buildings' (nZEB) construction is one of the leading-edge EU directions concerning the decarbonization of the building sector and the stimulation of energy transition in the construction sector. Therefore, improvements made regarding nZEB buildings' energy efficiency are of high importance to achieve the evolution of nZEBs to PE Bs (Positive Energy Buildings). In this study we present insights from a detailed energy audit of a passive house based on measured energy data. Data captured from a wide sensor grid (external and room temperature, CO2, and humidity sensors electrical energy meters etc) constituting the dwelling's BMS are analyzed and statistically processed so that the building's eff iciency to be evaluated. Through the detailed analysis of the buildings real time energy balance, the construction of energy consumption baselines and the evaluation of energy savings potentials that arise, new benchmark data are produced that may improve nZEB design modelling an d BEM (Building Energy Modelling) -BIM (Building Information Modelling) modelling in general. Finally, issues regarding energy production and storage are being discussed in terms of net metering and charging of electrical vehicles.

C19. V. N. Papadogianni, A. Romeos, **A. Giannadakis**, K. Perrakis, Th. Panidis, 2023, Flame Spreading in Confined Spaces, Mediterranean Combustion Symposium, Luxor, Egypt, January 23-26, 2023

This research investigates the potential fire hazard of fire originating in hidden (inaccessible) areas of the pressurized section of aircrafts. The objective was to establish a laboratory scale flammability test method to predict fire propagation behavior under real fire conditions. To this end a Confined Fire Apparatus (CFA) was designed and constructed, and a number of tests were performed in order to promote a better identification of the involved mechanisms, their consequences, and the estimation of flame spreading in hidden zone fires. In this work the experimental facility and flame spreading results obtained for a typical material involved in hidden fires, namely a ceiling panel, are presented and discussed. The experimental facility consists of a narrow passage in which a fire is initiated using a burner on a specimen exposed to a controlled heat flux. Experiments were performed in the absence of a forced flow. Flame spreading was estimated either by visual monitoring of the development of fire or by temperature measurements at certain locations in the specimen. Both methods provided similar results.

C20. P. Parissis , A. Romeos **, A. Giannadakis**, K. Perrakis , T. Panidis ,M.Peroulis, 2023, Experimental and Computational Study of an Occluded Artery with End to Side Anastomosis, 2nd International Conference on Medical Devices: Materials, Mechanics and Manufacturing Corfu, Greece 26-28 June 2023

The hemodynamic field of an occluded artery with an "end to side" anastomosis is studied experimentally as well numerically. The influence of a distal end to side anastomosis to the formation of vortical structures and flow field evolution are discussed, under pulsatile flow conditions.

C21. A. Panidis, A. Romeos, **A. Giannadakis**, K.Perrakis and Th. Panidis, 2023, Effect of Vortex Generators on the Flow Field of a Vertical Buoyant Jet, Turbulence, Heat and Mass Transfer 10, Rome, September 9-11, 2023

In this work, the effect of vortex generators (turbulators) on the velocity field of a free, vertical, axisymmetric and turbulent buoyant jet, emerging in a quiescent environment is investigated experimentally. Turbulent flows are encountered in a large variety of technological applications, such as the exhaust of flue gases from chimneys (thermal plumes) and vehicles, disposal of industrial waste into bodies of water, and the operation of gas turbines. In many such applications, the intensification of the mixing of the fluid stream with the ambient fluid is desired. Therefore, methods and techniques have been developed aiming at faster fluid mixing. The placement of vortex generators at the flow discharge, has been found to be one of the techniques for increasing the mixing rate of the fluid with the environment as it is a relatively simple and effective method. However, relative work in the literature is rather limited, and general equations that adequately describe their features have not been formulated. For this study, two types of delta vortex

generators were used, located at the jet exit. DPIV measurements of the generated flow field for isothermal and non-isothermal conditions are presented and discussed.

C22. D. Kotsopoulos, K. Kalogiannis, A. Romeos, **A. Giannadakis**, K. Perrakis, Th. Panidis and B. Chen, 2023, Turbulence, Heat and Mass Transfer 10, Rome, September 9-11, 2023

Power electronic devices and systems are used in a continuously increasing field of consumer and industrial applications. Following the trend to develop smaller and more powerful electronic devices, effective cooling has become a limiting factor. Therefore, active thermal management techniques are necessary in order to enable higher power densities, optimal control, and reduction of temperature peaks and swing amplitudes, leading to an increase of performance efficiency and life expectancy. To this end, spray-cooling with the use of refrigerants has emerged as a promising option, having the ability to dissipate large amounts of heat, while the surfaces of the electronic components can be maintained at a low and uniform operating temperature range, by suitable selection of refrigerant. Spray-cooling heat transfer is characterized by the combined effect of liquid film evaporation over the sprayed surface, turbulent forced convection heat transfer due to the impact of the sprayed droplets, formation of active nucleation sites and the creation of secondary nucleation points on the surface of the impinging droplets. In this work a spray cooling configuration utilizing R410A is investigated experimentally, with respect to the nozzle to surface distance and refrigerant mass flow rate.

Academic Teaching

Auxiliary

Institute	Department	Course	Start	End	Category
University Patron	Mechanical and Aeronautical Engineering	Technical Thermodynamics	01/09/2003	31/12/2008	Laboratory
		Heat Transfer	01/09/2003	31/12/2007	
Total Hours		**357**			

Independent

Institute	Department	Course
TEI Patras	Mechanical Engineering	Basic Principles of Rotor Fluid Mechanics
TEI Western Greece		Mechanical Installations and Constructions Design
Duration: 21.09.2009 to 31.08.2019		3 years and 6 months and 22 days
University of Peloponnese	Mechanical Engineering	Mechanical Installations Design I
		Mechanical Installations Design II
		Metrology
		Fluid Mechanics I
		Hydro Machninery
Duration: 16.10.2019 to 28.02.2025		1 year and 4 months and 28 days

Postgraduate Courses

1. **Integrated Computational Tools for Supervision & Study,** Postgraduate Course- MSc - Department of Mechanical Engineering of the University of Peloponnese, Mechanical Design with Digital Technologies Acad. Year 2022-2023, 2023-2024, 2024-2025
2. **Energy Efficiency of Buildings,** Postgraduate Course-MSc - Department of Electrical and Computer Engineering (ECE) of the University of Peloponnese, Modern Applications of Power Systems, Acad. Year 2023-2024, 2024-2025, 2025-2026

Supervision of Diploma of Graduate Thesis (indicative list)

Department of Mechanical Engineering and Aeronautics, University of Patras

1. Whirlpool flows with applications in combustion systems
2. Experimental study of lifting axisymmetric plumes
3. Swirl flows with applications in combustion systems; bubble type vortex breakdown
4. Two-dimensional beam flow field study using the P.I.V. technique
5. Experimental application of the PIV method for the measurement of flow fields – Application to axisymmetric output beam
6. Experimental study of reaction to fire of thermoplastic materials using cone calorimetry method
7. Experimental study of reaction to fire of wood materials using the cone calorimetry method
8. Experimental Study of the Reaction of Building Materials to Fire with the Cone Calorimetry Method and Development of a Correlation Model for Results with the Single Burning Object Attack Method
9. Experimental study of reaction to fire of cable insulation materials by cone calorimetry method
10. Study of the effect of Vortex Generators on the Dynamic Vertical Beam Flow Nucleus

Department of Mechanical Engineering, Technological Educational Institute of Western Greece-University of Peloponnese

11. Feasibility analysis of energy saving interventions using variable heating degree days
12. Experimental and detailed calculation of energy consumption of buildings
13. Energy planning and upgrading of a School Building
14. Energy upgrade study of a building complex of the Department of Mechanical Engineering, TEI of Patras.
15. Construction and characterization of thermal properties of vacuum frames.
16. Energy saving for heating an office building using solar panels
17. Performance study of energy fireplace, water and air, comparison between them and economic and technical analysis of performance – construction cost.
18. Energy inspection of an existing building - Energy saving proposals
19. Study of ventilation air conditioning in a hospital unit
20. Integration of bioclimatic design systems in a building - Economic and technical analysis of energy saving interventions in four climate zones
21. Statistical analysis of energy consumption of buildings at National and European level
22. Implementation of energy saving measures in an existing residence & study of Natural Gas installation
23. Correlation of Greece's production model based on electricity production and consumption data. Comparison with data from European Union member countries
24. Economic and technical analysis for the allocation of resources of energy saving programs at regional level
25. Evaluation of alternative heating-cooling systems for a residential building
26. Reaction of materials to fire by cone calorimetry method

27. Energy Audit of Open Swimming Pool
28. Experimental Study of Elevator Energy Consumption
29. Energy consumption modeling and implementation of shared photovoltaic installation for apartment buildings and residential complexes
30. Energy Analysis of a Greenhouse Unit
31. Energy Audit of Cargo Ships

Teaching Work Evaluation

This section presents the evaluation of the teaching and notes of the course Mechanical Installations and Constructions (Theory-Laboratory) by the students of the Department of Mechanical Engineering of the University of Peloponnese, for the academic semester 2021-2022. The primary results of the evaluation can be viewed here.

General Rating Scale	Very Much	Very	Moderate	Little	At all
	5	4	3	2	1

General Evaluation Average: 4.30/5.0

Number of respondents: 89

Question	AVG.
1. The material (main book, slides, notes, exercises) used for the lesson helped me understand it	4.61
2. Numerous examples and explanations were given for a better understanding of the material	4.59
3. The flow of information was not fragmentary but had an evolutionary course	4.34
4. Different forms of teaching were used (lectures, tutorials, workshops, etc.) which complemented each other	4.08
5. Information communication technologies (ICT) were used for the teaching of the material and its practical application	4.37
6. The bibliographic sources (according to the course outline) given by the instructors helped me to better understand the course	4.24
7. In this lesson, I wondered what I learn, and if I benefit (if my knowledge is enriched)	4.15
8. From teaching the course I learned to look for ways to substantiate different points of view	4.22
9. Most of what I learned in this course was really interesting	4.68
10. The teachers tried to convey to us their enthusiasm about the subject	4.72
11. My participation in groups helped me understand the lesson.	4.00

Question	AVG.
12. The teachers patiently explained the obscure points	4.51
13. I enjoyed participating in this course	4.31
14. The teachers responded satisfactorily to our questions and concerns	4.61
15. The teachers helped us understand the reasoning and how to draw conclusions	4.59
16. The link between tasks and expected learning outcomes was satisfactory	5.00
17. The teachers provided me with the necessary support in order to complete the assignments	4.67
18. The teachers' observations on my work helped me improve the way I learn and study	4.50
19. The assignments helped me to apply my existing knowledge	4.67
20. I benefited from the course in my knowledge and understanding of the subject (according to the course outline).	4.32
21. I benefited from the course in the ability to solve problems	4.17
22. I benefited from the course in special skills or techniques (according to the course outline)	3.85
23. I benefited from the lesson in the ability to cooperate	2.83
24. I benefited from the lesson in personal organization and responsibility for learning.	3.74
25. I benefited from the course in the ability to communicate knowledge and concepts.	3.89
26. I benefited from the course in the ability to locate information relevant to the subject.	4.07

Management Experience

During my professional career I have held positions of responsibility related to policy making on scientific and development issues. The following is a brief analysis of the administrative experience as it is composed by the production of administrative and scientific work.

Administrative Work

- Founding Corporate Member of ESSENCON G.P. – Energy Consulting Company (2019- today)
- President Technical Chamber of Greece, Department of Western Greece (18.06.2010 to 13.01.2017)
- Member of the Management Committee of the Technical Chamber of Greece (06.05.2017-30.11.2018)
- Member of the Joint Monitoring Committee of the Program Agreement for the project "Establishment of Decentralized Natural Gas Supply Systems in the P.W.G." (2015-2017)
- Member of the Monitoring Committee of NSRF 2007-2013, 2014-2020 (Regional Operational Programme of Western Greece) (2011-2017)
- Member of the Innovation Council of Western Greece (2011-2013)
- Member of the Board of Directors of the Prefectural Development Company of Achaia (2010-2011)
- Member of the Technical Chamber of Greece Delegation (2013-2019)
- Member of the Technical Chamber of Western Greece Delegation (2006--2025)
- Member of the Technical Chamber of Greece in Research and Technology (2003-2006)

Organization and Participation in Scientific/Development Workshops and Conferences

The following is an indicative record of scientific and development workshops and conferences with participation or presentation during the last six years

- 1st - 6th Energy Forum (Natural Gas, Energy Saving in the Industrial Sector, Hydrocarbons, Renewable Energy Sources, Emission Rights in the Industrial Sector, Smart Grids for the Production and Management of Electricity and Heat, Interconnection of Research and Entrepreneurship in the Energy Sector, Training of Technical Personnel in the Hydrocarbons Sector, (Technical Chamber of Greece, 2012-2017)
- Blue Growth Patras (Hellenic Association of Young Entrepreneurs of Western Greece, 2016)
- Project Management (Hellenic Open University, 2016)
- Funding opportunities for LIFE & Interreg Greece-Italy 2014-2020 (TEI of Western Greece, 2016)
- Update on the Prevention and Suppression of Fires (P.Y. VIPE, 2015)
- Be Part of the Future | Deep Energy Renovation | Conference and Workshops (Institute of Zero

Energy Buildings – INZEB.ORG, 2015)

- Compliance of Electromechanical Equipment with specifications according to CE-Forum Development (TCG/DWG, 2015)
- Safety Technician tools in the modern workplace (PSDMH, TCG/DWG, 2015)
- Fire Protection of Buildings and Facilities (TEE/DPE, 2015)
- DIDSOLIT-PB – Development and implementation of decentralized, innovative solar energy technologies for public buildings in Mediterranean countries (Institute of Innovation & Sustainable Development "AEIPLOUS", 2014)
- Management and Operation Body of the Piros-Parapiros Dam (PWG, TCG/DWG, 2014)
- Green Business Innovation (University of Patras, 2014)
- Integrated Water Resources Management towards Sustainable Development (University of Patras, Technical Chamber of Greece, 2012)
- Strategic Environmental Impact Studies for the Exploration and Exploitation of Hydrocarbons in Western Greece (PDE, TEE/TDE 2012)
- Guidelines for Protection, Safety and Prevention of Risks at Work (TCG/DWG, 2012)