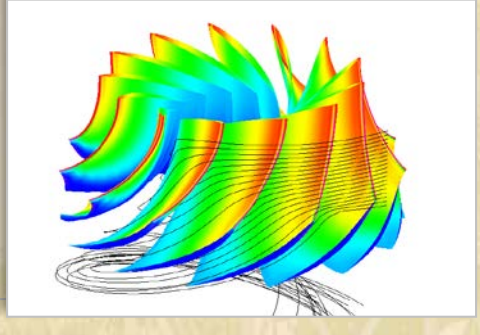
University of Thessaly

School of Engineering

DEPARTMENT OF MECHANICAL ENGINEERING



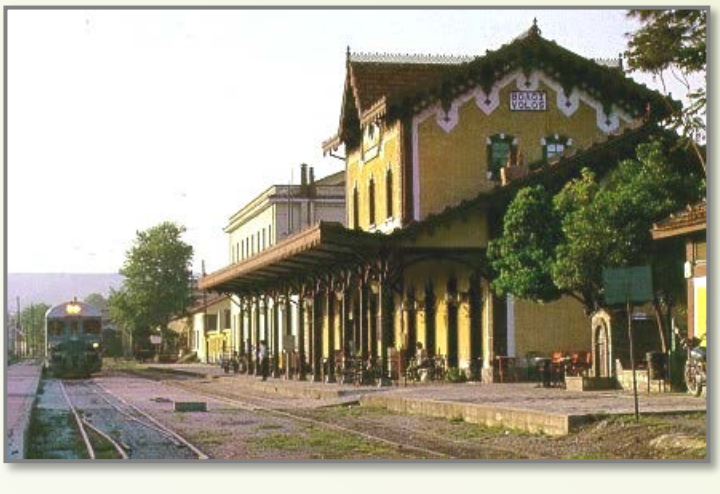
Research Activities

Volos, October 2019

THE CITY OF VOLOS AND THE UNIVERSITY

The city of Volos, at the head of the Pagasitikos Gulf, at the foot of Mount Pilion, is the main sea outlet of the large agricultural region of Thessaly. The metropolitan area of Volos has a population of 145 thousand inhabitants and includes the municipalities of Volos, Nea Ionia, Iolkos, Agria and surrounding communities. Volos has evolved into an industrial centre and the third port of the country. Its economy is based on manufacturing, trade, services and tourism.

The relation of Volos with the University is determined by a dynamic and creative interaction between the academic and the local communities. The spontaneous atmosphere of student life is diffused into the town with the lively interaction of students and residents, bringing a wealth of new ideas (http://www.volos-m.gr).



THE UNIVERSITY OF THESSALY

The University of Thessaly was founded in 1984. The central administration of the University is located in Volos, conveniently located between Athens (320 km) and Thessaloniki (200 km).

The University of Thessaly is organized in the following Schools and Departments that are distributed in four cities in the Region of Thessaly (Volos, Larissa, Trikala and Karditsa) and one city in the Region of Central Greece (Lamia):

School of Humanities and Social Sciences (Volos): Department of Primary School Education, Department of Early Childhood Education, Department of Special Education, Department of History, Archaeology and Social Anthropology, Department of Culture, Creative Media and Industries and Department of Language and Intercultural Studies.

School of Engineering (Volos): Department of Planning & Regional Development, Department of Mechanical Engineering, Department of Civil Engineering, Department of Architecture, Department of Computer and Communication Engineering.

School of Agricultural Sciences: Department of Agriculture Crop Production and Rural Environment (Volos), Department of Ichthyology and Aquatic Environment (Volos), Department of Agrotechnology (Larissa), Department of Animal Science (Larissa) and Department of Food Science and Human Nutrition (Karditsa).

School of Health Sciences: Department of Medicine (Larissa), Department of Veterinary Medicine (Karditsa), Department of Biochemistry & Biotechnology (Larissa), Faculty of Nursing (Larissa), Faculty of Public and Integrated Health (Karditsa) and Department of Physiotherapy (Lamia).

School of Technology: Department of Energy Systems (Larissa), Department of Environment (Larissa), Department of Digital Systems (Larissa) and Department of Forestry and Wood Science (Karditsa).

School Of Economics and Business: Department of Economics (Volos), Department of Accounting and Finance (Larissa)

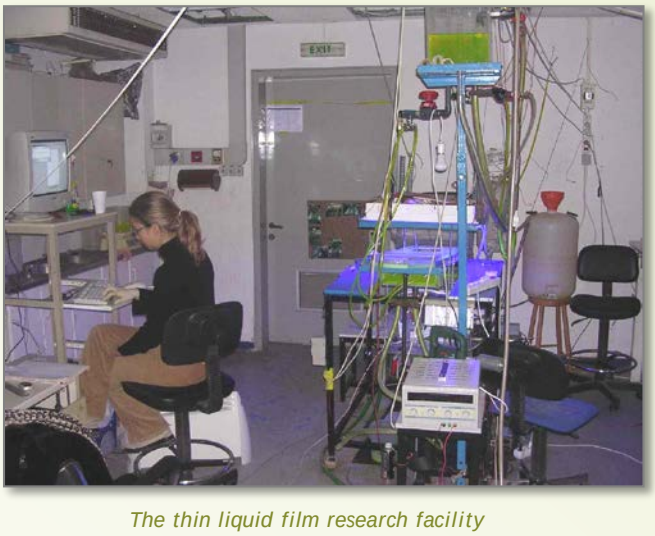
School of Physical Education and Sport Science: Department of Physical Education and Sport Science (Trikala) and Department of Nutrition and Dietetics (Trikala).

School of Science (Lamia): Department of Computer Science and Biomedical Informatics, Department of Computer Science Department of Physics and Department of Mathematics.

THE DEPARTMENT OF MECHANICAL ENGINEERING

The Department of Mechanical Engineering was founded in 1985 and admitted its first undergraduate students in 1990. The Department has a rapidly growing Mechanical engineering programme with state-of-the-art educational and research activities. The Department is housed in modern facilities of the School of Engineering campus located in the city of Volos. The main teaching goal of the Department is to prepare Mechanical Engineers with high technical training, who are able to study, understand, analyze and solve scientific and technological problems in mechanical engineering, adapt to a constantly developing economic and technical environment, contribute to the development of the country and the international community.

The Department is developing and running modern teaching and research laboratory facilities that allow it to participate in national, European and international teaching and research. It also seeks to establish a bridge between academic research and industrial development in the fields of mechanics, materials science, energy technology and production and supply chain management. The faculty is providing expert R&D support to industrial units and government agencies in Greece.



The thin liquid film research facility

MISSION AND OBJECTIVES OF THE GRADUATE STUDIES PROGRAMME

The Department offers a graduate programme leading to the degree of Doctor of Philosophy and, starting from the academic year 2018-2019, two Postgraduate Programmes in “Analysis and Management of Energy Systems (AMES)” and in “Supply Chain Management and Logistics (SCML)”. Priority is given to doctoral candidates. Research is strongly emphasized because of its importance to the advancement of science and engineering and the vitality it adds to the education provided by the Department.

The graduate curriculum provides students with advanced scientific skills to conduct fundamental and applied research. The main goal of the graduate studies is the preparation of scientists and engineers to support the local, national and European industry, as well as the research institutions and universities.

The faculty is involved in a variety of fundamental and applied research in close collaboration with Greek and European industry. Novel results are systematically published in international, peer-reviewed scientific journals.

ADMISSION AND REQUIREMENTS

Admission to the Graduate Program

Students graduated from Greek or foreign universities are admitted as follows:

- *Graduates from all Engineering disciplines*
- *Graduates of Physics, Chemistry, Mathematics and Computer Science*
- *Graduates of Technological Educational Institutes may also be admitted upon successful examination.*

Degree requirements

All admitted graduate students are required to pass successfully a series of graduate courses taught by the department faculty. Graduate students for the Master of Science degree are also required to complete a Graduate Research thesis. Graduate students for the Doctoral degree are required to complete a PhD thesis.

The subsonic wind tunnel facility

Degree Duration

The minimum duration of the Advanced Master of Science degree is two (2) semesters of courses and one (1) semester of research. The minimum duration of the PhD degree is three (3) years.

Course Fees - Scholarships

Graduate students are required to pay a fee of 900 Euros per semester. Course fees may be waived and scholarships may be awarded depending on academic qualifications and performance.

The scanning electron microscope

AREAS OF RESEARCH

- Fluid mechanics & industrial applications, aeroelasticity, magnetohydrodynamics, particle-gas/liquid flow, reacting flow, blood flow
- Biomechanics, interfacial and hydrodynamic stability
- Transport phenomena, two-phase liquid/gas flow, analysis and design of transport processes
- Kinetic theory, non-equilibrium flows and transport phenomena, microfluidics, vacuum flows
- Internal combustion engines, design of energy systems, pollution abatement technologies
- Design and development of fuel cells and catalytic materials for hydrogen production from biomass
- Energy and water conservation in industry
- Alloy Design, Computational Alloy Thermodynamics and Kinetics, Automotive TRIP steels, Aircraft Aluminium and Magnesium Alloys, Hydrogen Trapping and Embrittlement, Welding HAZ Modelling
- Continuum mechanics, plasticity, fracture mechanics, computational mechanics, finite elements
- Non linear structural analysis – structural stability
- Structural mechanics, analysis & design of steel structures
- Probabilistic structural dynamics, structural identification and control, structural reliability, design optimisation
- Optimal, robust and adaptive systems control, estimation and identification, robotics
- Manufacturing processes, tribology, metrology, machine tools, engineering design
- Modelling and analysis of production-inventory systems, operations research
- Technology, innovation and knowledge management
- Total quality management, reliability and maintenance
- Transport science, logistics, network equilibrium and optimisation methods
- Analytical and numerical techniques in engineering

Internal combustion engine test bed

DEPARTMENT DIVISIONS & LABORATORIES

Teaching and research in the Department of Mechanical Engineering is carried out in **three Divisions**, each incorporating the following laboratories.

DIVISION OF ENERGY, INDUSTRIAL PROCESSES & POLLUTION ABATEMENT TECHNOLOGY

Laboratory of Alternative Energy Conversion Systems

(Director: *Prof. P. Tsiakaras*)

Thermodynamics, Environmental Catalysis, Catalytic Combustion, Chemical Reactor and Reaction Engineering, Fuel Cell Engineering, Batteries, Electric Vehicles

Laboratory of Fluid Mechanics & Turbomachinery

(Director: *Prof. N. Pelekasis*)

Fluid Mechanics, Aerodynamics, Pumps, Turbomachines, Wind Turbines, Aeroelasticity, Environmental Flows, Reacting Flow, Particle-gas/liquid Flow, Blood Flow, Magneto-hydrodynamics, Flow Diagnostics (Laser etc), Computational Fluid Dynamics

Laboratory of Thermodynamics & Thermal Engines

(Director: *Prof. T. Stamatellos*)

Applied Thermodynamics, Internal Combustion Engines, Exhaust Emissions and Exhaust After-treatment, Industrial Refrigeration, Heating, Ventilation and Air Conditioning, Building Energy Systems

Laboratory of Transport Processes & Process Equipment

(Director: *Prof. V. Bontozoglou*)

Transport Phenomena, Mass Transfer, Physical & Chemical Process Equipment, Analytical and Computational Methods in Thermal Science, Kinetic Theory of Gases, Pollution Abatement Technology, Renewable Energy Sources (biomass, geothermal etc.)

DIVISION OF MECHANICS, MATERIALS & MANUFACTURING

Laboratory of Manufacturing

Manufacturing Technology, Machine Tools, Metrology, Tribology, Robotics

Laboratory of Materials

(Director: *Prof. G. Haidemenopoulos*)

Structure-Property-Processing Relationships in Metals & Alloys, Physical Metallurgy, Materials Characterization, Mechanical Behaviour, TRIP Steels, Aluminium and Magnesium Alloys, Welding , Corrosion Testing, Fractography, Failure Analysis

Laboratory of Mechanics and Strength of Material

(Director: *Prof. N. Aravas*)

Mechanics of Materials, Computational Mechanics, Elasticity, Plasticity, Fracture Mechanics, Continuum Mechanics, Mechanics of Structures, Biomechanics, Applied Mathematics, Mechanical Behavior of Materials, Mechanical Testing of Materials

Laboratory of System Dynamics

(Director: *Prof. C. Papadimitriou*)

Analysis, Design and Optimization of Dynamic Systems, Vibrations and Dynamics of Machines, Uncertainty Analysis, Stochastic Structural Dynamics, Diagnostics & Reliability of Mechanical Systems

DIVISION OF PRODUCTION & INDUSTRIAL MANAGEMENT

Laboratory of Production Management

(Director: *Prof. G. Liberopoulos*)

Operations Research & Management Science (Optimization, Stochastic Modelling, Discrete Event Dynamic System Simulation), Production and Operations Management (Planning & Control of Production-Inventory Systems, Reliability & Maintainability Engineering), and Design of Energy Markets.

Laboratory of Systems Optimization

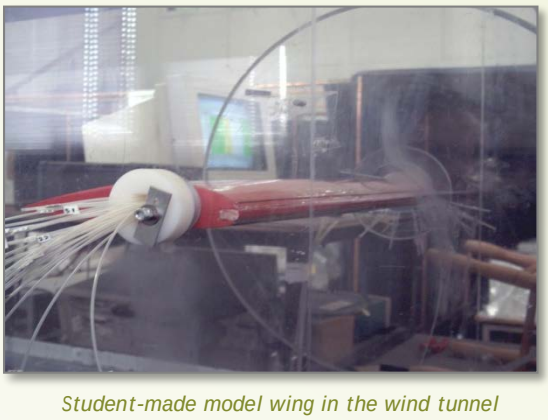
(Director: *Prof. A. Ziliaskopoulos*)

Stochastic Optimization Methods, Online and Robust Routing and Scheduling, Assignment Methods (Online and Offline, Equilibrium Modelling, Knapsack Algorithms

DIVISION OF ENERGY, INDUSTRIAL PROCESSES & POLLUTION ABATEMENT TECHNOLOGY

Laboratory of Alternative Energy Conversion Systems: Fully computerised mass spectrometer – Omnistat Balzers, Fully computerized gas chromatographs (TCD, FID) - PerkinElmer, Sigma300 and Shimadzu, Gas analyzers (CH_4, CO_2, CO, O_2, H_2, NO_x) – Hartmann and Braun, Function generators – AMEL, Fully computerized mass flow controllers-Brooks, Fully computerized Electrochemical Station-AMEL system 5000, Digital multimeters, Duel Cells – SOFC type and PEMFC type.

Laboratory of Fluid Mechanics & Turbomachinery: Subsonic wind tunnel (50x70 cm^2, 30 m/s), Supersonic wind tunnel (10x10 cm, Mach 1.5, *under construction*), Air tunnel (1in. jet, 50 m/s - 2×60 cm channel, 10 m/s), Laser Doppler anemometer (1-channel), Phase Doppler anemometer (1-channel), Hot wire anemometer (2-channels), In-house particle image velocimeter (PIV), Schlieren flow visualization, Video & digital camera, Workstations with printers and scanner, Computational Fluid Dynamics packages (GLASS3D, FUSION2D&3D, CORE2D, DIAN3D, TEACH, Aero-elasticity CAFFA2D, MHD CAFFA2D, FLUENT, PHOENICS), 2D and 3D Compu-tational Fluid Dynamic Finite Element & Boundary Element packages, Digital signal processing systems, Parallel programming on PC clusters.



Student-made model wing in the wind tunnel

Laboratory of Thermodynamics & Thermal Engines: Engine test cell with a 150 kW, Froude-Consine computer controlled eddy current dynamometer with TEXCEL 100 direct digital control system (transient testing capabilities), Controller linked to a PC Data Acquisition system, A DW10 2-liter HDI diesel engine. Engine management system (ECU) interfacing software and hardware, Ruggerini Brio 91 single cylinder engine with mini-scale filters and catalytic converters. Exhaust gas analyzers (CO, CO_2, HC, NO), HC FID analyzer, Air and fuel flow meters, Catalytic converter and diesel filter systems. Specially designed test rig for detailed flow distribution measurements in catalytic converters and filters, Laboratory oven (900ºC max) for aging and regeneration of full-sized converters and diesel filters, Networked PC's and peripherals, In-house software for performance computations of main types of exhaust after-treatment devices, integrated in the form of a CAE design toolkit, TRNSYS 15/IISiBat software for (advanced vehicle concepts, solar energy systems, building energy systems).

Laboratory of Transport Processes & Process Equipment: Horizontal and vertical 25 mm i.d. pipelines for gas-liquid flows, two inclined film flow channels, fluorescence imaging system, CCD and high-speed video cameras, heat exchanger test-bench, flow-pressure-temperature sensors/ controllers, thermo-gravimetric analysis, bomb calorimeter, UV-spectro-photometer, gas chromatograph, water characterisation instruments (conductivity meter, pH meter, turbidity meter, viscometer, refractometer etc.), PC network, commercial and in-house software, cluster consisting of 40 PCs with 64 bit processors and 2 GB RAM each, in-house computer codes.

DIVISION OF MECHANICS, MATERIALS & MANUFACTURING

Laboratory of Materials: Metallurgical microscopes and stereomicroscopes. Hardness and microhardness testers, Heat treating furnaces, Metallographic specimen preparation facilities, Corrosion testing equipment. Thermal analysis equipment including differential scanning calorimeter (DSC) and dilatometer, Scanning electron microscope (SEM), Atomic force microscope (AFM), Laboratory CO_2 laser facility with 2-axis CNC table, cutting head and vacuum chamber for Laser chemical vapor deposition (LCVD), Computational alloy thermodynamics software (Thermo-Calc), Computational alloy kinetics software (DICTRA).

Laboratory of Manufacturing: Milling machine, Automatic lathes, Drilling machine, Piezoelectric dynamometers, Profilometer, Tool makers' microscope, Stereoscope, Vibration analyzer, Tribometer (pin on disc), Viscometers, Metrological height machine, Hardness meter.

Laboratory of Mechanics and Strength of Materials: LMSM has a materials testing facility and a computer laboratory. MTS uniaxial servo-hydraulic testing unit, with a maximum force capacity of 100 KN, for static (tensile, compression, bending, shear), dynamic (fatigue) as well as fracture (crack propagation, fracture toughness) and residual strength testing. KYOWA PCD-300A portable data acquisition unit that is suited for strain/displacement measurements in laboratory mechanical testing facilities as well as in-service structural applications under static and dynamic loading conditions; the unit enables the simultaneous measurement for 8 sensors (strain gauges or LVDT). The computer lab has workstations, printers, and scanners. Available software includes: Finite element packages (ABAQUS, ANSYS) and software for computational mathematics (Mathematica).

Laboratory of System Dynamics: Experimental structural dynamics and control hardware: 2 16-channel data acquisition systems, 6 K-beam and 6 Piezobeam accelerometers, 2 impulse force hammers, magnetostrictive velocity/ displacement transducer, force transducer, electro-mechanical shaker, small centrifugal shaker, power amplifiers, 9 wireless IMOTE2 programmable sensor boards with 3-axial accelerometer, temperature, humidity and light sensors for infrastructure health monitoring applications. Computational dynamics software: COMSOL Multiphysics (Commercial finite element software for solving multi physics problems), SDTools (Experimental modal analysis, finite element modelling, structural dynamics and updating). In-house developed GUI software: MI-Tool for structural identification, FEMUS for structural model updating and validation based on data.

DIVISION OF PRODUCTION & INDUSTRIAL MANAGEMENT

Laboratory of Production Management: It includes a Local Area Network of more than a dozen PC's providing access to various software on statistical analysis, optimization, discrete event system simulation, enterprise resource planning, total productive maintenance, queuing model analysis, and process system modelling.

Laboratory of Systems Optimization: 10 Workstations, a unix cluster composed of three SuperMicro dual-processor UNIX servers and one Win2003 Server, a number of printing and communication devices used in the lab's research, such as GPS-enabled phones, fully autonomous GPS tracking units etc. Fully equipped development environments for java, PHP, C++, Fortran, AIR. GIS applications, Web 2.0 applications for GIS data, spatial data databases, optimization software such as AMPL/CPLEX.

GENERAL FACILITIES

Computer Centre

A modern Digital Computer Centre has been developed to serve the educational and research needs of the Department. Two local networks based upon the TCP/IP and Novell/IPX protocols are connected with the GUnet and GRnet networks to facilitate communication with other computing sites in Greece and worldwide via Internet.

Electromechanical Workshop

The teaching and research activities of the Department are supported by the Electro-Mechanical Workshop where test sections and special constructions are manufactured.

Library

The scientific literature needs of students, researchers, and faculty of the Department are met by the University Central Library, the collections of which are fully computerized. Students and researchers have access to the majority of journals in the field of Mechanical Engineering via the University Intranet.

GRADUATE COURSES OFFERED

ACADEMIC YEARS 2018-2019 & 2019-2020

DIVISION OF ENERGY, INDUSTRIAL PROCESSES & POLLUTION ABATEMENT TECHNOLOGY

- Introduction to Thermal Sciences
- Fundamentals of Turbomachines and Internal Combustion Engines
- Solar Thermal Systems
- Renewable Energy Technologies with emphasis to Electrochemical Processes
- Energy and the Environment
- Measurement Techniques in Thermal Sciences
- Stability of Thermo-Hydraulic Systems
- Energy Management in Building and in Industry

DIVISION OF MECHANICS, MATERIALS & MANUFACTURING

- Advanced Finite Element Methods
- Advanced Mechanical Behaviour of Materials
- Advanced Physical Metallurgy
- Materials for Energy Systems
- Continuum Mechanics
- Fracture Mechanics
- Structural Analysis of Systems for Production, Storage and Transportation of Energy Recourses
- Physical Models of Manufacturing Processes
- Advanced Plasticity

DIVISION OF PRODUCTION & INDUSTRIAL MANAGEMENT

- Optimization Methods & Tools
- Analysis of Production & Inventory Systems
- Transportation & Logistics Strategic Management
- Supply Chain Simulation
- Transportation & Logistics Network Algorithms
- Supply Chain & Logistics Applications

SUMMER SCHOOLS

The faculty has been actively involved in the organisation of several education-oriented summer schools, attracting instructors and students from home and abroad.

FACULTY MEMBERS

Agoras Michalis, *Assistant Professor*

Ampountolas Konstantinos, *Associate Professor*

Andritsos Nikolaos, *Professor*

Aravas Nikolaos, *Professor*

Charalampous Georgios, *Assistant Professor*

Haidemenopoulos Gregory N., *Professor*

Karamanos Spyros A., *Professor*

Kermanidis Alexis, *Associate Professor*

Kozanidis George, *Associate Professor*

Liberopoulos George, *Professor*

Bontozoglou Vasilis, *Professor*

Pandelis Dimitris, *Associate Professor*

Papadimitriou Costas, *Professor*

Papathanasiou Thanasis, *Professor*

Pelekasis Nikos, Professor

Saharidis Georgios K.D., *Assistant Professor*

Stamatelos Tassos, *Professor*

Tsiakaras Panagiotis, *Professor*

Valougeorgis Dimitris, *Professor*

Ziliaskopoulos Athanasios, *Professor*

Michalis Agoras

Assistant Professor

Nonlinear Composite Materials - Homogenization Theories

Dr. Agoras received his Diploma in Mechanical and Industrial Engineering from the University of Thessaly in 2005 and his M.Sc. and Ph.D. in Mechanical Engineering and Applied Mechanics from the University of Pennsylvania in 2010. He joined the faculty at Volos in 2015. Before joining the Department, he worked as a Research Associate at Madrid' s Institute for Advanced Studies of Materials (2010-2013) and at the University of Pennsylvania (2013-2015).

Research Interests and Activities

His research interests include Mechanics of Composite, Polycrystalline and Smart Materials, Homogenization Theories, Microstructure Evolution, Material Instabilities, Phase Transformation, Coupling Effects, Computational Mechanics of Composites.

Dr. Agoras develops nonlinear homogenization methods and constitutive models for materials such as polycrystalline metals, porous ductile materials, shape memory alloys, semi-crystalline polymers, fiber-reinforced elastomers, etc. In addition, he studies the relation between the microstructure and the macroscopic properties of composite materials, including the onset of macroscopic instabilities and failure of these materials. The latter phenomena are manifested at the macroscopic scale as a result of the competition or synergy among softening and/or hardening effects induced by the evolution of the underlying microstructure at the microscopic scale.

Recent research projects:

(1) Macroscopic response and ductile failure of porous metals. Ductile fracture of metals is known to occur through the process of void nucleation, growth and coalescence. The main objective of the present project is to develop homogenization-based constitutive models for the macroscopic response and failure of porous ductile materials, incorporating microstractural information on the void shape, orientation and distribution, as well as on the evolution of these parameters as a function of the applied loading.

(2) Mechanical coupling effects in composite and polycrystalline materials. A wide range of materials, including polymer and metal matrix composites, polycrystalline metals and shape memory alloys, is known to accommodate deformation through both conservative and dissipative mechanisms (i.e., elastic and inelastic strains). These deformation mechanisms are distinct (uncoupled) at the microscopic scale but, due to the presence of microstructure, they interact strongly with each other. As a result, the individual contributions of elastic and inelastic strains to the total strain cannot be separated (coupling) at the macroscopic scale. The prime scope of this project is to develop homogenization-based constitutive models for the macroscopic behavior of these materials, accounting for fine microstructural features as well as for the simultaneous presence of both conservative and dissipative behavior.

Selected Publications

Agoras, M., Avazmohammadi, R. and Ponte Castañeda, P. Incremental variational procedure for elasto-viscoplastic composites and application to polymer and metal-matrix composites reinforced by spheroidal elastic particles. *International Journal of Solids and Structures* 97–98, 668–686, 2016.

Song D., Agoras, M. and Ponte Castañeda, P. The evolution of pore shape and orientation in plastically deforming metals: Implications for macroscopic response and shear localization. *Mechanics of Materials* 90, 47–68, 2015.

Agoras, M. and Ponte Castañeda, P. Iterated linear comparison bounds for viscoplastic porous materials with ellipsoidal microstructures. Journal of the *Mechanics and Physics of Solids* 61, 701–725, 2013.

Agoras, M. and Ponte Castañeda, P. Homogenization estimates for multiscale nonlinear composites. *European Journal of Mechanics A/Solids* 30, 828–843, 2011.

Agoras, M., Lopez-Pamies, O. and Ponte Castañeda, P., 2009. A general hyperelastic model for incompressible fiber-reinforced elastomers. *Journal of the Mechanics and Physics of Solids* 57, 268–286.

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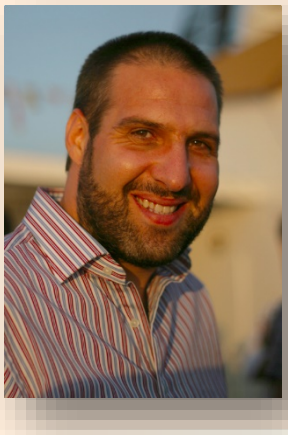
Konstantinos Ampountolas

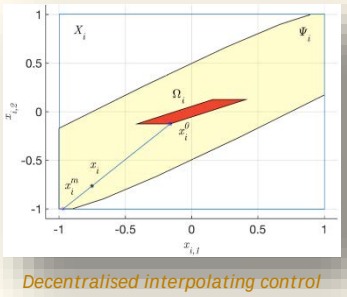
Associate Professor

Automatic Control Systems in Mechanical Engineering



Dr Ampountolas received the Diploma in Production Engineering & Management (1999), the M.Sc. Degree in Operations Research (2002), and the Ph.D. in engineering (2009), all from the Technical University of Crete, Greece.

He joined the Department of Mechanical Engineering at the University of Thessaly (UTH) in 2019. Before to joining UTH, he was a Senior Lecturer with the James Watt School of Engineering at the University of Glasgow (UofG, 2013-2019), U.K., and an Associate Director at UofG's Urban Big Data Centre (2019). He was a research fellow at Ecole Polytechnique Fédérale de Lausanne (2012-2013), Switzerland, a visiting researcher at the University of California, Berkeley, CA (2011), and a post-doc at the Centre for Research and Technology Hellas, Greece (2010). He has also held short-term visits at Technion–Israel Institute of Technology, Israel (2014), Chalmers University of Technology, Sweden (2016), and the Federal University of Santa Catarina, Florianópolis, Brazil (2016; 2019).



Decentralised interpolating control

Research Interests and Activities

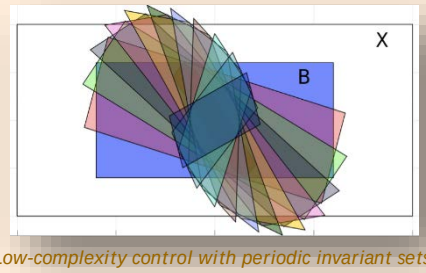
Research interests include automatic control and optimisation theory with emphasis on applications to traffic, transport, and automotive systems, large-scale networks, and further areas. Specific areas of current research include:

(1) Set invariance methods for the decentralised constrained control of interconnected systems (with Sheila Scialanga)

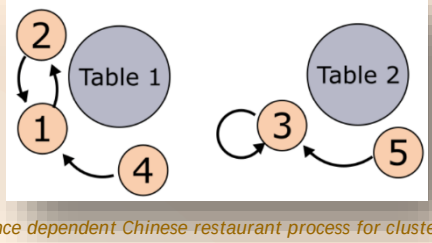
(2) Bayesian non-parametric clustering approaches for spatio-temporal datasets generated by sensors and user-generated content (with Ludger Evers and Ashwini Venkatasubramaniam)

(3) Information-theoretic methods for the semi-optimal selection and location of traffic sensors (with Ruzanna Jusoh)

(4) Traffic control in the era of connected & automated vehicles (with Chao Zhang)



Low-complexity control with periodic invariant sets



Distance dependent Chinese restaurant process for clustering

Selected Publications

Ampountolas, K., Alves dos Santos, J., Carlson, R.C., Motorway tidal flow lane control. *IEEE Transactions on Intelligent Transportation Systems*, doi:10.1109/TITS.2019.2945910, early access, 2019.

Ampountolas, K., Zheng, N., Geroliminis, N., Macroscopic modelling and robust control of bi-modal multi-region urban networks. *Transportation Research Part B* 104, 616-637, 2017.

Christofa, E., Ampountolas, K., Skabardonis, A., Arterial traffic signal optimization: A person-based approach. *Transportation Research Part C*, 66, 27-47, 2015.

Aboudolas, K., Geroliminis, N., Perimeter and boundary flow control in multi-region heterogeneous networks. *Transportation Research Part B*, 55, 265-281, 2013.

Kouvelas, A., Aboudolas, K., Kosmatopoulos, E.B., Papageorgiou, M., Adaptive performance optimization for large-scale traffic control systems. *IEEE Transactions on Intelligent Transportation Systems*, 12 (4), 1434-1445, 2011.

Aboudolas, K., Papageorgiou, M., Kouvelas, A., Kosmatopoulos, E.B., A rolling-horizon quadratic-programming approach to the signal control problem in large-scale congested urban road networks. *Transportation Research Part C,* 18 (5), 680-694, 2010.

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Nikolaos Andritsos

Professor

Experimental Transport Phenomena

Dr Andritsos received his Diploma in Chemical Engineering from Aristotle University of Thessaloniki in 1979, his M.Sc. from University of Manchester (U.K.) in 1981 and his Ph.D. in Chemical Engineering from the University of Illinois at Urbana-Champaign (USA). He joined the faculty at Volos in 2003. Before joining the Department, he was affiliated with the Chemical Process Engineering Research Institute in Thessaloniki for 16 years.

Research Interests and Activities

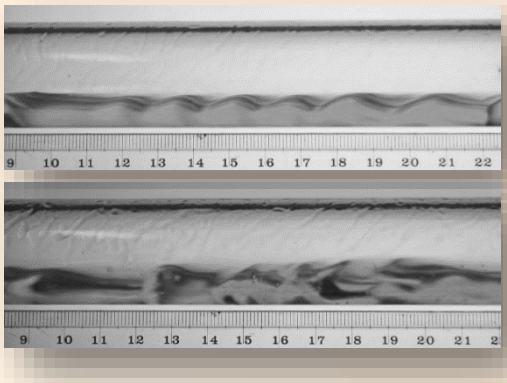
Research interests include the flow of two-phase mixtures in pipelines, the formation and control of scale deposits in industrial systems (heat exchangers, geothermal water equipment, oil and gas transportation systems, RO and UF membrane systems etc.), water conservation and treatment, removal of hexavalent chromium from waters, exploitation of geothermal energy (including geoexchange systems) and stone deterioration and conservation.

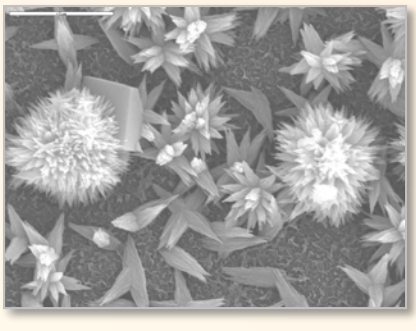
Representative research projects are:

(1) A better understanding of gas-liquid two-phase flows and particularly: (i) The effect of fluid properties on the gas-liquid flow in a horizontal and near-horizontal pipelines. (ii) The effect of fluid properties in upward flow in a vertical pipe. (iii) The effect of drag-reducing polymers on two-phase flow characteristics in a large diameter horizontal pipeline.

(2) Development of a magnetic nanostructured solid for efficient removal of hexavalent chromium, Cr(VI), from potable water. The project includes the design and the operation of a pilot-scale unit for water treatment and the application of a magnetic field for the recovery of the used material.

(3) Optimal design of low and medium-enthalpy geothermal systems in Greece (e.g. Akropotamos and Alexandroupolis fields in Northern Greece, Santorini Island etc.)





$CaCO_3$ deposits on an RO membrane.

Selected Publications

Tzotzi, C., Bontozoglou, V., Vlachogiannnis, M. and Andritsos, N. Effect of Fluid Properties on Flow Patterns in Two-Phase Gas-Liquid Flow in Horizontal and Downward Pipes. *Industrial & Engineering Chemistry Research*, 50 (2), pp 645–655, 2011.

Kostoglou, M., Chrysafis, N. and Andritsos, N. Modelling Tomato Dehydration in a Tunnel Dryer using Geothermal Energy. *Drying Technology: An International Journal*, 31, pp 5-16, 2013.

Tzotzi, C. and Andritsos, N. Interfacial Shear Stress in Wavy Stratified Gas-Liquid Flow in Horizontal Pipes. *Int. J. Multiphase Flow*, 54, pp 43-54, 2013.

Simeonidis, K., Kaprara, E., Samaras, T., Angelakeris, M., Pliatsikas, N., Vourlias, G., Mitrakas, M. and Andritsos, N. Optimizing magnetic nanoparticles for drinking water technology: The case of Cr(VI). *Sci. Total Environment,* 535, pp. SI 61-68, 2015.

Fytikas, M. and Andritsos, N. *Geothermal Energy – Geothermal Resources, Geothermal Fluids, Applications, Environment*. Tziolas Editions, Thessaloniki, Greece (2004). [In Greek]

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Nikolaos Aravas

Professor

Computational Mechanics of Structures

Dr Aravas received his Diploma in Mechanical Engineering from the Aristotle University of Thessaloniki in 1980, his M.Sc. (1982) and Ph.D. (1985) in Theoretical and Applied Mechanics from the University of Illinois at Urbana Champaign (USA). He joined the faculty at Volos in 1996. Before joining the Department, he was a Professor of Mechanical Engineering and Applied Mechanics at the University of Pennsylvania (USA) (1986-1996), and a Senior Engineer at Hibbitt, Karlsson & Sorensen (1985), the developers of the ABAQUS general-purpose finite element program. At the University of Thessaly Prof. Aravas has served as Vice Rector for Research and Development (1999-2002) and Dean of Enginee-ring (2004-2007). Dr. Aravas is a Fellow of the American Society of Mechanical Engineering (ASME).

Research Interests and Activities

Professor Aravas' research is in the areas of Mechanics of Materials, Computational Mechanics and Finite Element Methods, Plasticity, Fracture Mechanics, Metal Forming, Continuum Mechanics, and Biomechanics.

In particular, Prof. Aravas has worked on the development of crack-tip asymptotic solutions in ductile materials, the analysis of testing methods for material interfaces such as the peel test, the development of numerical methods for the integration of elastoplastic models, on constitutive models for the anisotropic plastic behavior of polymers and the plasticity and creep of metal-matrix composites reinforced by continuous aligned fibers, on strain-gradient elasticity and plasticity theories with applications in nano-materials, the mechanics of Transformation Induced Plasticity (TRIP), the mechanics of metal forming, and the mechanics of the human foot.

Recent research projects focus on the following areas:

(1) A "plastic-strain-gradient" version of an isotropic elastoplastic damage model that depends on the third invariant J_3 of the stress deviator is developed. The model is based on the "non-local" equivalent plastic strain e^p and introduces a "material length" l to the constitutive equations. The non-local plastic strain e^p at a material point P can be identified with the average value of the local von Mises equivalent plastic strain ε^p over a sphere centered at P and of radius approximately equal to $3l$. A methodology for the numerical integration of the constitutive equations is developed. The algorithm is appropriate for rate-independent as well as rate-dependent (viscoplastic) models.

(2) The accurate description of the mechanical behavior of non-linear composite materials is a challenging problem. In this project we derive a general model for N–phase isotropic, incompressible, rate-independent elasto-plastic materials at finite strains. The model is based on the nonlinear homogenization variational (or modified secant) method which makes use of a linear comparison composite (LCC) material to estimate the effective flow stress of the nonlinear composite. The homogenization approach leads to an optimization problem which needs to be solved numerically for the general case of an N–phase composite. In the special case of a two-phase composite an analytical result is obtained for the effective flow stress of the elasto-plastic composite material. The model is validated by periodic three-dimensional unit cell calculations comprising a large number of spherical inclusions (of various sizes and of two different types) distributed randomly in a matrix phase. The formulation is subsequently extended to include hardening of the different phases. The model is in excellent agreement even in the case where each of the phases has a rather different hardening response.

Selected Publications

I. Papadioti, N. Aravas, J. Lian, and S. Münstermann, "A strain-gradient isotropic elastoplastic damage model with J_3 dependence", *International Journal of Solids and Structures*, Vol. **174-175**, pp. 98–127, 2019.

J. Lian, W. Liu, I. Papadioti, I. Bellas, S. Chandran, P. Verleysen, H. Richter, N. Aravas, and S. Münstermann, "Plasticity and failure behavior modeling of high-strength steels under various strain rates and temperatures: microstructure to components", *Structural Integrity Procedia*, Vol. **13**, pp. 1421–1426, 2018.

A. Kordolemis, A.E. Giannakopoulos, and N. Aravas, "Pretwisted beam subjected to thermal loads: A gradient thermoelastic analogue", *Journal of Thermal Stresses*, Vol. **40**, pp. 1231–1253, 2017.

S. Mao, P.K. Purohit, and N. Aravas, "Mixed finite element formulations in piezo-electricity and flexoelectricity", *Proceedings of the Royal Society A*, Vol. **472** Issue 2190, Article Number 20150879, 2016.

I. Papadioti, K. Danas, and N. Aravas, "A methodology for the estimation of the effective yield function of isotropic composites", *International Journal of Solids and Structures*, Vol. **87**, pp. 120–138, 2016.

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Georgios Charalampous

Assistant Professor

Thermofluid Processes with Energy Applications

Dr Charalampous received his Diploma in Mechanical Engineering from AUTh in 1999, his M.Sc. in Advanced Mechanical Engineering from Imperial College (UK) in 2000 and his Ph.D. in Mechanical Engineering from Imperia College (UK) in 2009. He joined the faculty at Volos in 2017. Before joining the Department, he was a Research Associate at the Mechanical Engineering department of Imperial College for 10 years.

Research Interests and Activities

Research interests focus on fluid mechanics and energy applications, including fuel injection, atomisation and sprays, combustion, mixing, particle laden flows and on the development of novel optical instrumentation for flow measurements, such as the LIF/Mie technique for droplet sizing and the optical connectivity technique.

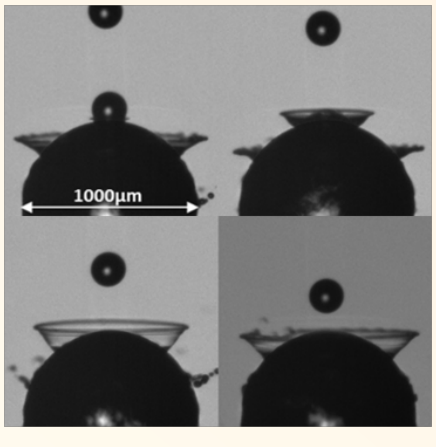
Representative research projects include:

(1) Breakup of liquid droplets is encountered in many industrial applications including inkjet printing and spray drying of products such as foodstuffs, household detergents, pharmaceuticals, or carbide particles. Understanding how droplets break up is important for the process optimisation for energy savings and improved production capability. Experimental investigations are carried out on droplet breakup by droplet collision on particles and breakup by aerodynamic droplet acceleration. By high-magnification optical imaging, morphological maps of the breakup outcomes based on the flow parameters are developed and the breakup process is quantified in detail and can be implemented in analytical models and computational tools.

(2) Plasma ignition is an attractive alternative to spark ignition because it offers free choice of ignition position, precise ignition timing, no quenching effects, no disturbance of the flow-field and absence of erosion. It is also attractive for ignition of lean mixtures used to reduce fuel consumption and satisfy emission regulations but are more difficult to ignite. Plasma ignition is examined experimentally for fuel injection in homogenous isotropic turbulence without mean flow and relationships are developed between the minimum ignition energy (MIE) , the flow turbulence and jet injection characteristics, mixture fraction and ignition position.

(3) Injection of alternative fuels. The most convenient way to utilise alternative fuels is direct substitution of the conventional fossil fuels with alternative fuels (drop-in substitution). The change in the injection characteristics of the liquid fuel jet at the exit of the injection nozzle that control spray formation and combustion characteristics, are experimentally examined by means of dual-frame Laser-induced Fluorescence. The effect of the fuel jet physical properties is ascertain in terms of the morphological fuel jet characteristics and interfacial velocities of the fuel jet.

(4) Planar droplet sizing by LIF/Mie technique is the only technique that can measure mean droplet size across full spray cross sections. The technique offers significantly increased measurement throughput in comparison to alternative techniques but there are limitations on the sizing accuracy. Lorenz-Mie theory simulations and analytical modelling are used to develop guidelines for the optimal measurement accuracy tailored to the optical setup and sprayed liquid. The technique is further developed to measure the droplet size spread across full spray cross sections.



Selected Publications

Charalampous G, Hardalupas Y, (2017), “Collisions of droplets on spherical particles”, Physics of Fluids , 29(10): 103305

Sung, Y., G. Charalampous, Y. Hardalupas and G. Choi (2017). "Laser ignition and flame characteristics of pulsed methane jets in homogeneous isotropic turbulence without mean flow." Proc.of the Combustion Institute 36(2): 1653

Charalampous, G. and Y. Hardalupas (2016). "How do liquid fuel physical properties affect liquid jet development in atomisers?" Physics of Fluids 28(10): 102106

Charalampous, G. and Y. Hardalupas (2011). "Method to reduce errors of droplet sizing based on the ratio of fluorescent and scattered light intensities (laser-induced fluorescence/Mie technique)." Applied Optics 50(20): 3622

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Gregory N. Haidemenopoulos

Professor

Physical Metallurgy-Alloy Design

Dr Haidemenopoulos received his Diploma in Mechanical Engineering in 1982 from AUTh and his Ph.D. in Physical Metallurgy from Massachusetts Institute of Technology (MIT), USA, in 1988. He joined the faculty at Volos in 1992.

Research Interests and Activities

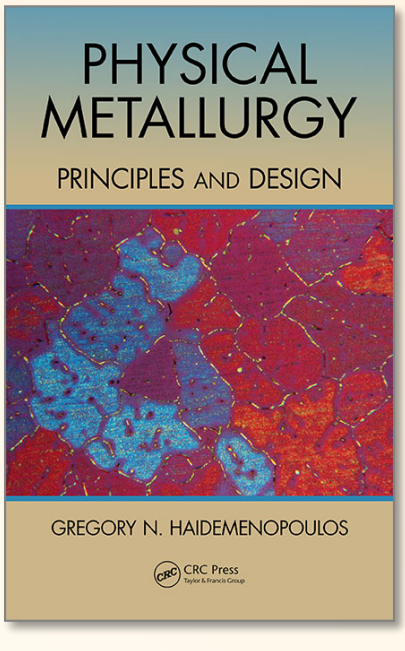
Structure-Processing-Properties-Performance interactions in metallic materials. Application of computational alloy thermodynamics and kinetics in alloy design, process design and simulation of heat treatments and welding processes. Microsegregation, homogenization and strengthening of Al-alloys. TRIP steels and Medium-Mn steels: solute partitioning, austenite stabilization, constitutive modeling, fracture and fatigue. Hydrogen trapping and embrittlement in high-strength aluminium alloys. Mechanisms of Deformation and Fracture of metallic alloys.

Developer of the ALLOYNEERING concept for the design of materials and processing (www.alloyneering.com).

Recent research activities are focused on the following projects:

[1] Toolkit for the design of damage tolerant microstructures- TOOLKIT (2016-2019). Funding Organization: EU-Research Fund for Steel and Coal (RFCS). Partners: Steel Companies (Thyssen Krupp Stahl, OCAS, Korinth Pipeworks), Universities (RWTH-Aachen, University of Ghent). The project aims at developing microstructural configurations that provide the required properties for damage tolerance in dual phase and HSLA steels. Design of suitable processing parameters to achieve thw tailored microstructures (in collaboration with Prof. N. Aravas).

[2] Development of affordable integrated lightweight components from flexible 3G medium-Mn steels – LightChassis (2017-2020). Funding Organization: Research Fund for Steel and Coal (RFCS). Partners: Salzgitter Mannesmann Forschung, Autotech Engineering, RWTH-Aachen, Centro Ricerche FIAT, ISQ). The project aims to design and deliver chassis components made from novel 3rd generation advanced high-strength medium-Mn steels. Computational alloy design will be applied in order to determine optimum alloy compositions and process windows. The alloy will be produced by novel belt casting technology. The component design will include detailed forming and welding analysis [3] Effect of austenite stability on the fatigue of TRIP steels (2009-2012)



Selected Publications

G.N. Haidemenopoulos, N. Aravas and I. Bellas, Kinetics of Strain-Induced Transformation of Dispersed Austenite in Low-Alloy TRIP Steels, Materials Science and Engineering A 615, pp.416-413, 2014

H. Kamoutsi, G.N. Haidemenopoulos, V. Bontozoglou, P.V. Petroyiannis and S. Pantelakis, Effect of Prior Deformation and Heat Treatment on the Corrosion-Induced Hydrogen Embrittlement in Aluminum Alloy 2024, Corrosion Science, 80, pp.139-142, 2014

H. Kamoutsi, E. Gioti, G.N. Haidemenopoulos, Z. Cai and H. Ding, Kinetics of solute partitioning during intercritical annealing of a medium-Mn steel, Metallurgical and Materials Transactions A, 46, No.11, pp. 4841-4846, 2015

G.N. Haidemenopoulos, P. I. Sarafoglou, P. Christopoulos, A. D. Zevaki, Rolling contact fatigue cracking in rails subjected to in-service loading, Fatigue and Fracture of Engineering Materials and Structures, 39, pp.1161-1172, 2016

J.S. Aristeidakis and G.N. Haidemenopoulos, Alloy design based on computational thermodynamics ans multiobjective optimization: the case of medium-Mn steels, accepted for publication to Metallurgical and Materials Transactions A, Vol.48A, pp.2584-2602, 2017

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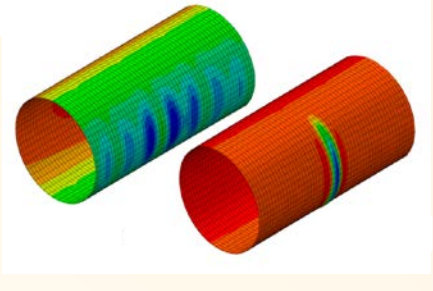
Spyros A. Karamanos

Professor

Structural Mechanics and Finite Elements

Dr Karamanos received his Diploma in Civil Engineering (1989) from NTU Athens with highest honors, his M.Sc. (1991) and his Ph.D. (1993) in Structural Engineering from The University of Texas at Austin (USA). He joined the faculty at Volos in 1999. Before joining the Department, he was affiliated with EGNATIA ODOS S.A. in Thessaloniki, Greece, as a structural engineer, and with Delft University of Technology, The Netherlands, as a Post-Doctoral Fellow in Steel Structures.



Research Interests and Activities

My research focuses on the development of Computational and Analytical Methods for Stress Analysis, Structural Stability, Inelastic Behavior and Metal Fatigue. Applications refer mainly to Steel Structures, including Tubular Structures, Industrial Equipment (e.g. Tanks, Pressure Vessels, Piping), Onshore and Marine Pipelines, and Offshore Structures for Hydrocarbon and Water Transmission. Present research activities include:

(1) Buckling of metal cylindrical shells. Development of computational methods for bifurcation and post-buckling response in metal shells and tubes with significant plastic deformations. Applications refer to liquid storage tanks, piping systems and pipelines.

(2) Fatigue of steel welded connections, for marine structures, pipelines and risers, as well as for offshore platforms. Of particular importance is the use of high-strength steel in offshore structural systems for renewable energy (fixed-bottom and floating systems for offshore wind energy production). The computational work is supported by key experiments performed, primarily at the University of Thessaly.

(3) Analysis and design of industrial steel structures (liquid storage tanks, pressure vessels and piping) and steel pipelines (conveying hydrocarbons or water) under severe earthquake loading, aimed at developing relevant design guidelines. A major research issues refers to numerical implementation of cyclic plasticity models in finite element software for steel materials and of soil-pipe interaction.

(4) Effects of manufacturing process on the structural performance of steel pipes, used in demanding pipeline applications (deep offshore, seismic areas etc.). Development of numerical tools for simulating Spiral, UOE and JCO manufacturing processes.

(5) Structural assessment and "fitness-for-purpose" of industrial structures (tanks, pressure vessels, piping) and pipelines (water, oil and gas) under severe loading, with emphasis on earthquake action.

The above research activities are funded mainly by the European Commission, with the participation of European steel and pipeline industry, National funding, and by industrial funding mainly from the steel and energy sector. See also: http://excellence.minedu.gov.gr/draseis/listing/483-hydrocarbon-transfer-storage

Selected Publications

Sarvanis, G. C., Karamanos, S. A., Vazouras, P., Mecozzi, E., Lucci, A., Dakoulas, P., "Permanent Earthquake-Induced Actions in Buried Pipelines: Numerical Modeling and Experimental Verification", *Earthquake Engineering and Structural Dynamics*, Vol. 47, No. 4, pp. 966–987, April 2018.

Antoniou, K., Chatzopoulou, G., Karamanos, S. A., Tazedakis, A., Palagas, C., Dourdounis, E., "Numerical Simulation of JCO-E Pipe Manufacturing Process and its Effect on the External Pressure Capacity of the Pipe.", *Journal of Offshore Mechanics and Arctic Engineering*, ASME, Vol. 141, No. 1, Article Number: 011704, February 2019.

Gavriilidis, I. and Karamanos, S. A., "Bending and buckling of internally-pressurized steel lined pipes", *Ocean Engineering*, Vol. 171, pp. 540–553, January 2019.

Chatzopoulou, G., Sarvanis, G. C., Karamanos, S. A., Mecozzi, E., Hilgert, O., "The effect of spiral cold-bending manufacturing process on pipeline mechanical behavior", *International Journal of Solids and Structures*, Vol. 166, pp. 167-182, July 2019.

Chatziioannou, K., Karamanos, S. A., Huang, Y., "Ultra low-cycle fatigue performance of S420 and S700 steel welded tubular X-joints", *International Journal of Fatigue*, Vol. 129, pp. 105221, December 2019.

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Alexis Kermanidis

Associate Professor

Mechanical Behaviour of Metallic Materials

Dr. Kermanidis received his Diploma in Civil Engineering in 1996 from the Department of Civil Engineering of the University of Patras.

He received his Ph.D. in Mechanical Engineering from the Department of Mechanical Engineering and Aeronautics, University of Patras, in 2003.

He joined the faculty at Volos in 2007.

Research Interests and Activities

Mechanical behaviour of metallic materials (aluminum alloys, high strength steels) and experimental procedures in the topics of fatigue and fracture.

Fatigue crack growth (FCG) analysis/prediction under constant and irregular loading conditions of aircraft aluminum alloys.

Effects of microstructure and processing (heat treatment processing, manufacturing processes) on mechanical behaviour of aluminum alloys and TRIP steels.

Mechanical behaviour of welded joints, effects of welding process on material properties at meso-scale.

Effects of corrosion on the mechanical performance of aluminium, magnesium alloys and aluminum alloy welds.

Mechanical Behaviour of external fixator systems used in medical applications for the treatment of bone uniformities in the field of biomechanics

Mechanical behaviour of honeycomb aluminium structures

Relevant research projects he has been involved in:

Development of short distance WELding concepts for AIRframes (WELAIR) , CEC 2004-2007, Partners: University of Patras, Airbus EADS , Piaggio, GKSS ONERA Dassault-Aviation, etc.

Corrosion and Hydrogen Embrittlement of Aircraft Aluminum Alloys, PENED, GSRT 1998-2000. Partners: University of Thessaly, University of Patras, Hellenic Aerospace Industry.

Detection, Evaluation and Control of Rolling Contact Fatigue in Railway Tracks (DECORAIL), (SYNERGASIA) 2011, NSRF 2013-2015, Partners: University of Thessaly, Demokritos National Research Centre, STASY Attiko Metro etc.

FAtigue STrength of COLD-formed structural steel details (FASTCOLD), RFCS-RPJ, 2017-2020. Partners: University of Thessaly, RWTH Aachen, University of Pisa, University of Porto, Fritz Schäfer GmbH , European Racking Federation etc.

Selected Publications

A.T. Kermanidis, A. D. Zervaki, G. N. Haidemenopoulos, and Sp. G. Pantelakis, Effects of temper condition and corrosion on the fatigue performance of a laser-welded Al–Cu–Mg–Ag (2139) alloy, Materials and Design 31, pp. 42–49, 2010.

G.N. Haidemenopoulos, A. T. Kermanidis, C. Malliaros, H.H. Dickert, P. Kucharzyk, W. Bleck, ":On the effect of austenite stability on high cycle fatigue of TRIP 700 steel", Material Science & Engineering A, 573 (2013) 7-11

A. Tzamtzis and A. T. Kermanidis, "Improvement of fatigue crack growth resistance by controlled overaging in 2024-T3 aluminium alloy" Fatigue Fract Engng Mater Struct 00 (2014), 1–13.

P.I. Christodoulou, A.T. Kermanidis, G.N. Haidemenopoulos, "Fatigue and fracture behavior of pearlitic Grade 900A steel used in railway applications", Theoretical and Applied Fracture Mechanics 83, 51-59 (2016)

A.T. Kermanidis and A. Tzamtzis, An experimental approach for estimating the effect of heat affected zone (HAZ) microstructural gradient on fatigue crack growth rate in aluminum alloy FSW, Materials Science & Engineering A 691 (2017) 110–120

A.T. Kermanidis, P. I. Christodoulou, E. Hontzopoulos, G.N. Haidemenopoulos, H. Kamoutsi, A.D. Zervaki, Mechanical performance of laser spot-welded joints in Al-Al/Cu solar thermal absorbers, Materials & Design, 155 (2018), 148-160.

P. I. Christodoulou, A. T. Kermanidis, G.N. Haidemenopoulos, D. Krizan, G. Polychronopoulou, Effect of retained austenite stability on cyclic deformation behaviour of low-alloy TRIP steels, Fatigue Fract. Eng. Mater. Struct., (2019), 1-15.

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George Kozanidis

Associate Professor

Optimization Methods in Production/Service Systems

Dr Kozanidis holds a Diploma from the University of Thessaly in Greece (1997), a MSc from Boston University in USA (1998) and a MSc and a PhD, both from Northeastern University in USA (2002). Between 2004 and 2007 he was an Adjunct Professor and a Postdoctoral Researcher at the Department. He joined the faculty as a Lecturer in 2007, and currently he is an Associate Professor.

Research Interests and Activities

Operations Research: Integer Programming, Design and Analysis of Optimization Algorithms, Stochastic Analysis and Modeling of Production/Transportation Systems, Multiobjective Optimization.

Currently undergoing research focuses on:

1. Mixed integer bilevel programming for optimal strategic bidding of energy producers in day-ahead electricity markets (with E. Kostarelou, P. Andrianesis and G. Liberopoulos). We address the problem of finding the optimal bidding strategy of an energy producer that participates in a day-ahead electricity market. The problem is formulated as a mixed integer bilevel optimization model, with the producer maximizing his individual profit, at the upper level, and an independent system operator clearing the market at the minimum total system bid-cost, at the lower level. For this class of problems, we develop specialized optimization solution algorithms, and we utilize them to address realistic problem cases.

2. Development of information technology tools and advanced operations research techniques for the efficient management of commercial airline operations (with A. Gavranis, P. Andrianesis and G. Liberopoulos). We develop specialized optimization algorithms (column generation, branch and price, assignment, etc.) for the efficient management of airline operations such as crew scheduling, fleet assignment, flight scheduling, tail assignment, commercial planning, vacation planning, preferential bidding, disruption handling, etc. We implement these algorithms in a modern integrated development environment using advanced programming languages, so that they can be readily applicable in realistic environments.

Selected Publications

G. Kozanidis (2018). Column generation for optimal shipment delivery in a logistic distribution network. D. Cinar, K. Gakis and P.M. Pardalos (eds.), Sustainable Logistics and Transportation, *Optimization and Its Applications*, Vol. 129, Ch. 5, Springer-Verlag, Berlin, 87-112.

G. Kozanidis (2018). Branch and price for covering shipments in a logistic distribution network with a fleet of aircraft. *Optimization Methods and Software*, 33(2): 221-248.

A. Gavranis and G. Kozanidis (2015). An exact solution algorithm for maximizing the fleet availability of a unit of aircraft subject to flight and maintenance requirements. *European Journal of Operational Research*, 242(2): 631-643.

G. Kozanidis, E. Kostarelou, P. Andrianesis and G. Liberopoulos (2013). Mixed integer parametric bilevel programming for optimal strategic bidding of energy producers in day-ahead electricity markets with indivisibilities. *Optimization*, 62(8): 1045-1068.

G. Kozanidis, A. Gavranis and E. Kostarelou (2012). Mixed integer least squares optimization for flight and maintenance planning of mission aircraft. Naval Research Logistics, 59(3-4): 212-229.

G. Kozanidis (2009). Solving the linear multiple choice knapsack problem with two objectives: profit and equity. *Computational Optimization and Applications*, 43(2): 261-294.

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George Liberopoulos

Professor

Production Management

Dr Liberopoulos received his B.S. and M.Eng. in Mechanical Engineering from Cornell University (USA) in 1985 and 1986, respectively, and his Ph.D. in Manufacturing Engineering from Boston University (USA) in 1993. In 1993 he was a Lecturer in the Department of Manufacturing Engineering (currently Mechanical Engineering) at Boston University, and during 1994-1996 he was a Visiting Research Scientist in Laboratoire de Méthodologie et Architecture des Systèmes Informatiques (currently Laboratoire d' Informatique de Paris 6) at Université Pierre et Marie Currie (Paris 6) and CNRS (France). In 1996, he joined the Department of Mechanical Engineering at the University of Thessaly, where he currently is Professor of Production Management and Director of the Production Management Laboratory.

Research Interests and Activities

Professor Liberopoulos's research interests focus on systems analysis with the use of operations research, applied probability and automatic control methods, and applications in production and operations planning and control, supply chain management, design of electricity markets, and other areas.

His past and more recent research themes include:

- Optimal flow control of unreliable manufacturing systems (with M Caramanis, J-Q Hu)
- Design and performance evaluation of kanban-type production control systems (with Y Dallery, C Chaouiya, S Koukoumialos, I Tsikis)
- Analysis of production-inventory control systems with advance demand information (with Y Dallery, F Karaesmen, S Koukoumialos, A Chronis)
- Reliability analysis and performance evaluation of automated production lines (with P Tsarouhas, G Kozanidis)
- Investigation of the effect of stockouts on the performance of inventory systems (with I Tsikis, S Delikouras)
- Optimal production scheduling in continuous-flow industries (with O Hatzikonstantinou, G Kozanidis, D Pandelis)
- Flight and maintenance planning of mission aircraft (with G Kozanidis, A Gavranis)
- Environmental vehicle routing (with, G Saharidis)
- Design and analysis electricity and reserve market mechanisms (with P Andrianesis, A Papalexopoulos, P Biskas, G Kozanidis, E Kostarellou)
- Optimal control policies in inventory systems with service-driven demand (with M Deligiannis)
- Analysis, planning, and control of large production and supply networks (with BOSCH, KIT, University of Cologne, University of Mannheim, Politecnico di Milano, Koc University, University of Limerick)

Selected Publications

Liberopoulos G (2019) Comparison of optimal buffer allocation in glow lines under installation buffer, echelon buffer, and CONWIP policies. *Flexible Services and Manufacturing Journal* (available online).

Liberopoulos G (2018) Performance evaluation of a production line operated under an echelon buffer policy. *IISE Transactions* 50(3):161-177.

Liberopoulos G, Andrianesis P (2016) Critical review of pricing schemes in markets with non-convex costs. *Operations Research* 64(1):17-31.

Andrianesis P, Liberopoulos G, Kozanidis G, Papalexopoulos AD (2013) Recovery mechanisms in day-ahead electricity markets with non-convexities – Part I: Design and evaluation methodology. *IEEE Transactions on Power Systems* 28(2):960-968.

Andrianesis P, Liberopoulos G, Kozanidis G, Papalexopoulos AD (2013) Recovery mechanisms in day-ahead electricity markets with non-convexities – Part II: Implementation and numerical evaluation. *IEEE Transactions on Power Systems* 28(2):969-977.

Liberopoulos G, Pandelis D, Hatzikonstantinou O (2013) The stochastic economic lot sizing problem for non-stop multi-grade production with sequence-restricted setup changeovers. *Annals of Operations Research*. 209(1):179-2015.

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Vasilis Bontozoglou

Professor

Transport Phenomena – Process Equipment

Dr Bontozoglou received a Diploma in Chemical Engineering from AUTh (1982), and MSc (1986) and PhD (1988) from the University of Illinois at Urbana-Champaign (USA). Before joining the faculty of the University of Thessaly in 1993, Dr Bontozoglou was affiliated for 4 years with the Chemical Process Engineering Research Institute in Thessaloniki. At the University of Thessaly, he has served as Vice Rector of Research and Development (2008-2012) and is presently Director of the Laboratory of Transport Processes. Dr. Bontozoglou is member of the Editorial Advisory Boards of the International Journal of Multiphase Flow (since 2011) and of Acta Mechanica (since 2013).

Research Interests and Activities

The main research interest is in the dynamics of multiphase flows and related mass/hear transport phenomena. Applications range from industrial processes to bio-medical phenomena.

Representative research projects are the following:

(1) Gravity-driven liquid film flows are central to a variety of process equipment. The objective of this project is to understand the complex dynamics of the free surface of the liquid film, which includes development and interactions of solitary waves, transition to three-dimensional instabilities and finally establishment of interfacial turbulence. Key areas of investigation are (i) the effect of a bounding wall with undulations and (ii) the modification of such flows by the inclusion of surfactants. The research combines analysis, direct numerical simulations and experiments.

(2) The inhalation of dry powders is relevant both to environmental pollution and to the delivery of drugs to the lungs. The objective of this project is to model gas-particle multiphase flow and in particular to predict the deposition patterns along the respiratory tract. Basic parameters considered are lung morphology, particle size distribution and breathing mode. A long-term goal is to predict the influence of occlusive or restrictive lung disease on the extent and pattern of particle deposition.

Selected Publications

K. Gourgoulianis, Z. Daniil, K. Athanasiou, S. Rozou and V. Bontozoglou 2017 Application of a one-dimensional computational model for the prediction of deposition from a dry powder inhaler. J. Aerosol Medicine and Pulmonary Drug Delivery, doi.org/10.1089/jamp.2016.1363.

V. Bontozoglou 2017 The effect of adsorption modeling on the stability of surfactant-laden liquid film flow. Acta Mechanica, doi.org/10.1007/s00707-017-1985-2.

S. Georgakakou, K. Gourgoulianis, Z. Daniil and V. Bontozoglou 2016 Prediction of particle deposition in the lungs based on simple modeling of alveolar mixing. Respir. Physiol. Neurobiol., 225, 8-18.

G. Karapetsas and V. Bontozoglou 2014 The role of surfactants on the mechanism of the long-wave instability in liquid film flows. J. Fluid Mech., 741, 139-155.

S. Chakraborty, P.-K. Nguyen, V. Bontozoglou and C. Ruyer-Quil, 2014 Extreme solitary waves on falling liquid films. J. Fluid Mech., 745, 564-591.

Z. Cao, M. Vlachogiannis and V. Bontozoglou 2013 Experimental evidence for a short-wave global mode in film flow along periodic corrugations. J. Fluid Mech., 718, 304-320.

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Pandelis Dimitris

Associate Professor

Stochastic Models of Operations Research in Industrial Management

Dr. Pandelis received his diploma in Naval Architecture and Marine Engineering from the National Technical University of Athens in 1987 and his M.Sc. and Ph.D degrees in Electrical Engineering: Systems from the University of Michigan in 1990 and 1994 respectively. After his doctoral studies he worked in the USA as a Research Scientist for ERIM International (1994-2000) and Tellabs Operations (2000-2001). He was a Visiting Assistant Professor in the Department of Mechanical Engineering of the University of Thessaly from 2003 to 2009, when he was elected Assistant Professor of Stochastic Models of Operations Research in Industrial Management.

Research Interests and Activities

Applied probability theory, stochastic optimization, queueing networks, flexible manufacturing systems, scheduling and resource allocation problems, supply chain management.

Current research projects include:

[1] Optimal control of flexible servers in queueing networks. Our research focuses on two-stage queueing systems with holding costs incurred by jobs in the system. We use Markov Decision Process theory to determine the structure of server allocation schemes that minimize expected costs for models with various forms of server collaboration (full, partial, no collaboration) and service disciplines (preemptive, non-preemptive). We also use numerical experiments to study networks with more than two nodes.

[2] Optimal ordering strategies for short life-cycle products under supply and demand uncertainty. We study newsvendor models with suppliers that may not deliver the whole quantity ordered by the retailer. To mitigate supplier uncertainty we investigate the use of a reliable backup supplier; the retailer reserves capacity in advance at an additional cost and exercises the option to buy any amount up to the reserved capacity after the delivered quantity from the unreliable suppliers becomes known. We analyze appropriate mathematical models to characterize optimal order and reservation quantities.

Selected Publications

Pandelis, D.G. Optimal control of non-collaborative servers in two-stage tandem queueing systems. Naval Research Logistics, 61, 435-436, 2014.

Pandelis, D.G., Karamatsoukis, C.C., and Kyriakidis, E.G. Finite and infinite-horizon single vehicle routing problems with a predefined customer sequence and pickup and delivery. European Journal of Operational Research, 231, 577-586, 2013.

Liberopoulos, G., Pandelis, D.G., and Hatzikonstantinou, O. The stochastic economic lot sizing problem for non-stop multi-grade production with sequence-restricted setup changeovers. Annals of Operations Research, 209, 179-205, 2013.

Pandelis, D.G. A note on preemptive scheduling of multiclass jobs with geometric service times and hard deadlines. Journal of Scheduling, 16, 423-428, 2013.

Parvin, H., Van Oyen, M.P., Pandelis, D.G., Williams, D.P., and Lee, J. Fixed task zone chaining: worker coordination and zone design for inexpensive cross-training in serial CONWIP lines. IIE Transactions, 44, 894-914, 2012.

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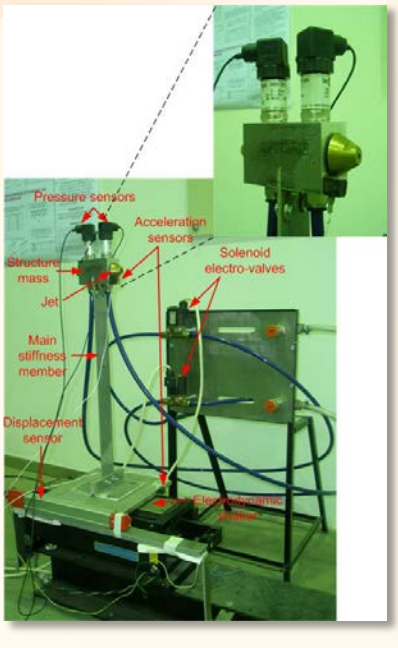
Costas Papadimitriou

Professor

Structural Dynamics

Dr. Papadimitriou received his Diploma in Mechanical Engineering in 1984 from the University of Patras and his MSc and PhD degrees from California Institute of Technology (CalTech) in 1985 and 1990, respectively. He joined the department in 1999 as an Adjunct Professor and in 2000 as an Associate Professor (promoted to Professor in 2005). Before joining the Department, he served as faculty member at Texas A&M Univ. (1991-1994) and as visiting faculty at CalTech (1994-1995, 1996-1998). He also held research positions at Hong Kong University of Science and Technology (1995-1996) and at Jet Propulsion Laboratory-JPL (1996-1998).



Research Interests and Activities

Research interests include uncertainty quantification in engineering science, Bayesian learning, probabilistic structural dynamics, finite element model validation and updating, structural identification and health monitoring, structural damage diagnosis and lifetime prognosis, Bayesian optimal experimental design, stochastic simulation methods, structural reliability, stochastic fatigue, design optimization under uncertainty, decision making under uncertainty.

Representative research projects are the following:

[1] PI: Dynamic virtualisation: modelling performance of engineering structures (DyVirt) (2018 - 2022). Funding: Marie Skłodowska-Curie Innovative Training Networks (ITN).

The aim of this ITN is to address the urgent challenge of how to model the performance of engineering structures that operate in dynamic environments. The process of building trusted virtual models for structures subject to high dynamic loads is called “dynamic virtualisation”. The research will go beyond the now ubiquitous process of creating computer-based simulation models of structural dynamics. Obtaining a valuable virtual model is no longer a question of computing power, but it rests in the more difficult problem of developing trust in the model through the process of Verification and Validation. Validation assesses the extent to which the virtual model accurately represents the system/structure being modelled, and thus the degree of trust that can be given to its predictions of real-world events. These challenges are most obvious in the renewable energy sector, where technology is developing at a very rapid pace, and more reliable models are required to cope with structures subjected to extreme loadings which lead to a high degree of nonlinearity and uncertainty. The objectives of the University of Thessaly research team are to develop Bayesian uncertainty quantification and propagation tools and Bayesian optimal experimental design tools within the dynamic virtualization project.

[2] Co-I: Novel Bayesian Methodology for Data-Driven Uncertainty Quantification and Propagation in Structural Dynamics (2019–2021). Funding: Research Grants Council Hong Kong (16212918).

This project aims to develop a reliable probabilistic methodology for structural monitoring and various related applications in civil structures, such as model updating, health monitoring, robust reliability and response prediction. This methodology has its roots in a general Bayesian framework that the PI, the Co-I, and their co-workers have been developing and refining over the past 20 years. We aim to address and resolve some of the major shortcomings encountered by the current formulation and unleash the full power of Bayesian methodologies. We plan to develop a holistic hierarchical Bayesian approach for model updating as well as robust prediction of the system response and reliability. Model reduction techniques, high-performance computing methods, and surrogate models will be combined and used to lighten the computational burden of high dimensional data and to reduce the model complexity.

Selected Publications

Sedehi, O., Papadimitriou, C., Katafygiotis, L., Probabilistic hierarchical Bayesian framework for time-domain model updating and robust prediction. Mechanical Systems and Signal Processing, 123, 648-673, 2019.

Papaioannou, I., Papadimitriou, C. and Straub, D., Sequential importance sampling for structural reliability analysis. Structural Safety, 62, 66-75, 2016.

Eftekhar Azam S., Chatzi, E. and Papadimitriou, C., A dual Kalman filter approach for state estimation via output-only acceleration measurements. Mechanical Systems and Signal Processing, 60-61, 866-866, 2015.

Papadimitriou, C. and Papadioti, D.C., Component mode synthesis techniques for finite element model updating. Computers and Structures, 126, 15-28, 2013.

Angelikopoulos, P., Papadimitriou, C. and Koumoutsakos, P., Bayesian uncertainty quantification and propagation in molecular dynamics simulations: A high performance computing framework. The Journal of Chemical Physics, 137(14), 144103, 2012.

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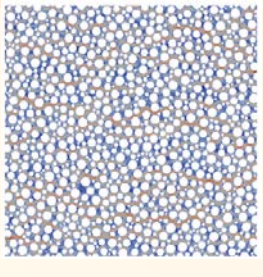
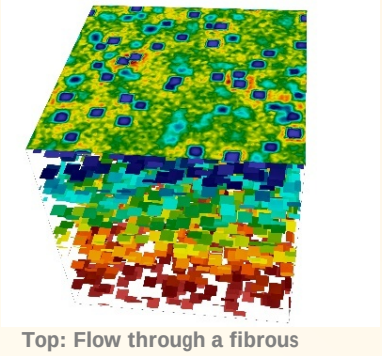
Thanasis Papathanasiou

Professor

Processing of Polymers and Composites

Dr Papathanasiou received his Diploma in Chemical Engineering from NTUA in 1985, his MSc in Chemical Engineering from the University of Calgary (1987) and his PhD from McGill University (1991) . He joined the ME Faculty at Volos in 2008. Prior to this, he was Associate Professor of Chemical Engineering at the University of South Carolina, USA, Unilever Lecturer in Process Engineering at Imperial College, London, UK (1992-1997), Director's Post-Doctoral Fellow at Los Alamos National Laboratory, USA (1991-1992) and Research Scientist at ALCAN Intl. R&D Center in Kingston, Canada. He received an European International Integration Grant in 2007.





Top: Flow through a fibrous structure [1,5]
Bottom: Diffusion in a flake composite [2,3]

Research Interests and Activities

I am interested in the investigation of processing-structure-property relationships in composite materials, as a prerequisite to optimal process and product design. Processes of interest involve either flow into complex cavities or channels (injection molding, calendering) and through fibrous media of complex internal structure (liquid molding, pultrusion) or transport in filled systems. Key to our approach is the use of computation to investigate the influence of microstructure on the details of the flow fields (processing-microstructure correlations) as well as on the details of concentration, thermal or stress fields (microstructure-property correlations). In addition we are interested in developing and testing realistic CAD models for composites manufacturing processes, with recent emphasis in die- and pin-assisted pultrusion. My work has been funded by the EU as well as by the US-NSF, US-DOD, US-ONR and US-DOE. Specific projects:

Micro-Scale Flows in Fibrous Media: We are interested in the computational investigation of flow patterns in fibrous media of complex internal structure, such as those encountered in liquid molding of high performance composites or in transport through biological media, and the determination of how such patterns are affected by microstructural details. Both Stokes' and finite Reynolds-number flows as well as flows of micropolar fluids are considered. The long-term objective is the development of quantitative models for the effective permeability (K) of fibrous media as function of microstructural parameters.

Flow through Dual-Scale Porous Media: Such media are ubiquitous in the area of composites fabrication, where different types of reinforcement in different stages of orientation and aggregation are combined to produce preform architectures with optimal processability and products with optimal on-site performance. Our work here is aimed at elucidating the micro-scale flow patterns occurring in these materials and, specifically, the interplay between micro- and macro-scale flows.

Transport across filled systems: We are using high performance computing (based on the BEM and the FVM) to investigate the manner in which the efficacy of filled systems is affected by their internal structure. Systems of interest include flake-filled membranes and particulate/fiber composites in which the dispersed phase shows various degrees of aggregation.

Realistic Modeling of Polymer/Composites Manufacturing Operations: We are interested in developing and using realistic CAD models for polymer manufacturing processes (see Figure), especially processes which make use of flow and geometry to achieve the infiltration of a resin into a fibrous/porous scaffold. Our objective is to combine large numbers of CAD results in order to propose and test explicit process models relating material and process parameters to fabrication outcomes – in the case of pin-assisted pultrusion, such a model for the extent of resin infiltration was recently proposed.

Selected Publications

1. E.G. Karvelas, A. Tsiantis and T.D. Papathanasiou, "Effect of Micropolar Fluid Properties on the Hydraulic Permeability of Fibrous Biomaterials", *Computer Methods and Programs in Biomedicine*, in print 2019.
2. A. Tsiantis and T.D. Papathanasiou" A novel FastRSA algorithm: Statistical Properties and Evolution of Microstructure", *Physica A: Statistical Mechanics and its Applications*, 2019.
3. Tsiantis A and T.D. Papathanasiou, "A closed-form solution for the barrier properties of randomly-oriented high aspect ratio flake composites", *Journal of Composite Materials*, 53, 16, 2239-2247, 2019.
4. N. Polychronopoulos and T.D. Papathanasiou, "Pin-Assisted Resin Infiltration of Porous Substrates", *Composites Part A – Applied Science and Manufacturing*, 71, 126-135, 2015.
5. Chen, X. and Papathanasiou, T.D. Micro-Scale Modeling of Axial Flow through Unidirectional Disordered Fiber Arrays. *Composites Science and Technology*, 67, 1286-1293, 2007.

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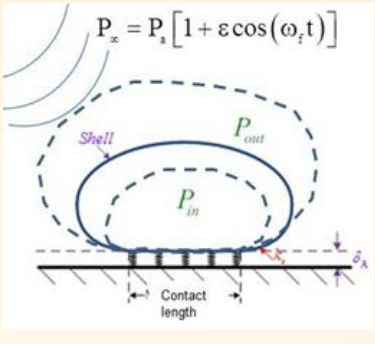
Nikos Pelekasis

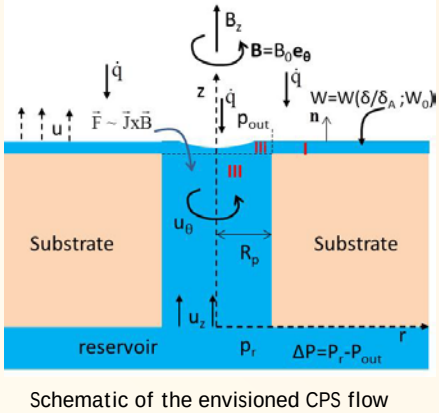
Professor

Computational Fluid Dynamics

Professor Pelekasis received his Diploma from NTUA in 1986 and his Ph.D. from the State University of New York at Buffalo (USA) in 1991. He joined the faculty at Volos in 2001.
Before joining the Department he was affiliated with the Chemical Eng. Dept. of the Univ. of Patras (1997-2001) and the Levich Institute for Physicochemical Hydrodynamics in CCNY (1992-1994).



Acoustic signature of an adhered microbubble



Schematic of the envisioned CPS flow arrangement in the pore level

Research Interests and Activities

- Dynamics and stability of films drops and bubbles in stratified and dispersed flow in the presence of acoustic, capillary and elastic forces - Biomechanics and Diagnostic Imaging with Ultrasound
- Magnetohydrodynamic stability – Flow Control and Optimization of Heat Transfer in the presence of Lorentz, inertia and adhesive forces.
- Numerical Techniques, Finite Elements, Boundary Elements and Parallelization.
- Bifurcation Theory & Dynamical Systems.

Our present research projects focus on the following areas:

[1] Interaction between a coated microbubble and a nearby wall- Effect of viscoelastic, intermolecular and acoustic forces: Research Project funded by the Niarxos Foundation (2018-2020). It is targeted towards the investigation of different numerical tools, to evaluate and distinguish the acoustic signatures of coated microbubbles, in terms of resonance frequencies, translation and backscatter, in adhesion and free circulation in narrow capillaries.

[2] Characterization of Contrast Agents for Medical Imaging and Drug Delivery with Ultrasound via Theoretical & Numerical Analysis of Static & Dynamic Response: Coordination of an ARISTEIA I Research project (2012-2015) funded by the Greek Ministry of Education, wiki http://contrast-aristeia.mie.uth.gr/wiki/.
This project provided convincing evidence regarding the mechanical behaviour of coated microbubbles as well as ways to obtain reliable estimates of their viscoelastic properties via static and acoustic measurements and the corresponding static and dynamic response patterns. The research effort is currently continued in order to account for the effect of confinement and adhesion in the vicinity of compliant and rigid substrates. In addition the potential for controlled production of coated microbubbles in flow focusing microfluiddic devices is investigated in collaboration with the Department of Bio-Engineering of the Technological University of Compiegne, France.

[3] Modelling activities of liquid metal PFC (Plasma Facing Components) solutions: Participation in the EUROPEAN fusion project and the Work Package WPDTT1 (2013-present) dedicated to the use of liquid metals as plasma facing components and power exhaust enhancers in the divertor region of fusion reactors. Coordination of the activity that focuses on the modelling of a capillary porous system (CPS) as a means to deliver liquid metal to the interface with plasma. The static arrangement of such a system has been identified, assuming the form of a micron size liquid metal layer whose actual shape heavily depends on the reservoir overpressure, pore topography and adhesive properties of the involved liquid metal. Currently, research focuses on the dynamic response of the CPS and the stability/cohesion of the protective liquid metal layer. In particular the effects of an external heat load, dynamic contact angle and realistic magnetic field configurations are investigated in order to predict criteria for the onset of destabilization and drop ejection in the presence of Lorentz, inertia, and adhesive forces coupled with liquid metal evaporation and depletion.

Selected Publications

M. Vlachomitrou & N. Pelekasis " Dynamic simulation of a coated microbubble in an unbounded flow: Response to a step change in pressure", JFM 822, 717-761 (2017).

A. Lytra & N. Pelekasis, "Static response of coated microbubbles: Modeling simulations and parameter estimation" Procedia IUTAM 16 (2015) 123 – 133.

N. Pelekasis, L. Benos, Static Arrangement of a Capillary Porous System (CPS): Modelling, Fusion Eng. and design 117, 180-187, 2017.

D. Dimopoulos & N. Pelekasis "3d Stability analysis of Rayleigh- Bénard Convection of a liquid metal layer in the presence of a magnetic Field – Effect of wall electrical conductivity", Fluid Dyn. Res. 46 (2014) 055507, (31 pp).

K. Tsiglifis & N. Pelekasis, "Dynamic simulations of insonated contrast agents", Physics of Fluids 25, 032109 (2013).

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Georgios K.D. Saharidis

Assistant Professor

Operations Research and Industrial Management

Dr Saharidis received his Diploma degree in production engineering and management from the Technical University of Crete, Chania, Greece, in 2001, and his MSc and PhD in supply chain management form Ecole Centrale Paris, France in 2002 and 2006, respectively. He joined the faculty at Volos in 2010. Before joining the department he was a senior research associate of transportation engineering (2008-2010) at the Center for Advanced Infrastructure and Transportation, New Jersey (USA) and chemical & biochemical engineering (2006-2008) at Rutgers - the state university of New Jersey (USA).

Research Interests and Activities

Dr Saharidis specializes in developing models, optimization methods and decision support systems for large-scale problems. One of his domains of interest is decomposition methods applied in large-scale problems of the supply chain. He is applying optimization models and algorithms to large-scale problems arising in mechanical engineering, transportation, civil engineering, environmental engineering, chemical engineering, industrial engineering and other problem domains of engineering. His research has offered a number of unique solutions approaches that open new opportunities in the area of mathematical programming. He had developed novel acceleration methods for Benders decomposition algorithm and bi-level optimization which have been applied in different engineering problems. Dr. Saharidis works on different research projects such as journey planning, green vehicle routing, freight logistics and maritime transportation, port planning and berth scheduling, intermodal terminals and distribution facilities planning and cross-docking scheduling, freight, shipping, and port logistics systems. The focus of his teaching has been on the development and application of optimization models and algorithms to the design, management and operation of transportation systems and operational research.

Selected Publications

Tang L., Jiang W. and Saharidis G.K.D. "An improved Benders decomposition algorithm for the logistics network design problem with capacity expansions of existing warehouses" Annals of Operations Research, 2013; 210(1): 165-190.

Azad N., Saharidis G.K.D., Davoudpour H., Malekly H. and Yektamaram S.A. "Strategies for protecting supply chain networks against facility and transportation disruptions: An improved Benders decomposition approach" Annals of Operations Research, 2013; 210(1): 125-163.

Saharidis G.K.D., Kolomvos G., Liberopoulos G. "Modeling and Solution Approach for the Environmental Traveling Salesman Problem" Engineering Letters, 22(2): 70-74, 2014.

Azad N., Davoudpour H., Saharidis G.K.D. and Shiripour M. "A new model to mitigating random disruption risks of facility and transportation in supply chain network design" International Journal of Advanced Manufacturing Technology, 2014; 70: 1757–1774.

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Tassos Stamatelos

Professor

Internal Combustion Engines

Dr Stamatelos received his Diploma in 1984 and his Ph.D. in Mechanical Engineering in 1988 from Aristotle University of Thessaloniki. He joined the faculty at Volos in 1991.

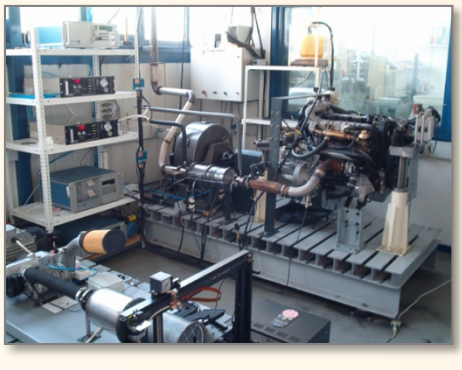
Research Interests and Activities

Internal combustion engines. Automotive exhaust treatment systems: design optimization, control and diagnostics. Mathematical modeling of catalytic converters and diesel filters. Design and transient simulation of building HVAC systems. Performance analysis of photovoltaic installations. Study and optimization of advanced power generation cycles. Environmental monitoring (PM10).

Industry- funded research projects carried out in the Lab include the Development and experimental validation of Computer Aided Engineering (CAE) tools to support exhaust after-treatment systems design and optimization, in the frame of a large envelope project aiming at the further development, customization and experimental validation of in-house CAE software transferred to industrial partners. System types addressed include Catalytic converters for SI engines, Diesel oxidation catalytic converters, Diesel particulate filters, catalytically assisted (1D-3D), NOx reduction catalysts for Gasoline Direct Injection and Diesel engines.

Performance analysis of grid-connected photovoltaic systems. Quality assurance procedures for the processing PV park monitoring data. Assessment of the effect of Air Mass and Atmospheric Clearness Index. Development of a network of stations for monitoring PM10 concentration in Volos. Analysis of data from ambient PM10 concentration monitoring in Volos in the period 2005-2014.

Activities with EC and public funding include the Computational Fluid Dynamics analysis of the Scavenging Process on a MAN B&W 2-stroke Marine Diesel Engine for different inlet port geometries and exhaust valve timing. Also, the study of a Diesel Filter system to reduce smoke emissions of high speed passenger ships during entrance and exit from Greek island harbors.



Selected Publications

E. Roumpakias and A. Stamatelos, Comparative performance analysis of grid-connected photovoltaic system by use of existing performance models. Energy Conversion and Management Vol. 150, 2017, 14-25

D. Tziourtzioumis and A. Stamatelos, Experimental Investigation of the Effect of Biodiesel Blends on a DI Diesel Engine's Injection and Combustion. Energies 2017, 10 (7), 970

A.A. Gkountas, A.M. Stamatelos, A.I. Kalfas, Recuperators investigation for high temperature supercritical carbon dioxide power generation cycles. Applied Thermal Engineering, Vol 125, 2017, Pages 1094-1102

A.-M. Stamatellou and A. Stamatelos, Overview of Diesel particulate filter systems sizing approaches. Applied Thermal Engineering, vol. 121 (2017) pp. 537-546

O. Zogou and A. Stamatelos, Diagnosis and Reduction of Electricity Consumption Exceedance in Public University Buildings. The Open Fuel and Energy Science Journal 2014, 7, 34-46

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Panagiotis Tsiakaras

Professor

Catalysis, Electrocatalysis & Fuel Cells

Prof. Tsiakaras received his 5-years Diploma on 1984 and his 2-years MSc on 1987, both from the Dept of Industrial Chemistry - University of Messina (Italy).
On 1992 he awarded with the Eurodoct price and the same year he defended his PhD at the Dept of Chemical Engineering of the University of Patras (GR). Two years later (1994), after his post-doctoral studies in Louvain-la-Neuve (Belgium), Twente (Holland) and Aristotle University of Thessaloniki (GR), he was appointed at the Dept of Mechanical Engineering, University of Thessaly.
Prof. Tsiakaras received for his studies Scholarships from Greek, Italian & Belgium research Institutions.
On 1996 he founded the laboratory of Alternative Energy Conversion Systems (Greece) and on 2012 the Laboratory of Electrochemical Devices based on Solid Oxide Proton Electrolytes at the Institute of High Temperature Electrochemistry of the Russian Academy of Sciences, Ekaterinburg Russian Federation.
On 2017 he was awarded with Ecopolis price for his overall scientific work.
Prof. Tsiakaras has been visiting Professor: i) at the Department of Industrial Chemistry & Materials Engineering of the University of Messina-Italy (period May-July of 2010), ii) at the National Council of Research (CNR-ITAE), Italy (period April-June 2014 and June 2018) and iii) at the department of Chemical Engineering of the Ural Federal University, Russia (2017-2019). He speaks fluently and writes English and Italian.

Research Interests and Activities

The research interests of Professor Tsiakaras are focused in the fields of: i) catalytic and electrocatalytic processes, ii) solid state electrochemistry, iii) electrochemical devices (fuel cells, electrolyzers, sensors, supercapacitors, electrochemical reactors etc.) design and development, iv) Direct Ethanol Fuel Cells for energy production and v) Catalysis for hydrogen production from renewable fuels. The last two decades, Prof. Tsiakaras received for his research activities more than 8 MEu from national and international competitive research programmes.

Teaching/Tutoring: Prof. Tsiakaras teaches since 1994: i) in the graduate program of Mechanical Engineering Department the courses of chemistry for engineers and advanced energy conversion systems, and ii) in the postgraduate. Up today, Professor Tsiakaras has supervised (at the Dept of ME-UTH) 12 PhD students. Few of them (4) are University Professors and few (4) research associates and high ranked executives. Moreover he has supervised 40 MSc and more than 100 graduate students. He was invited to teach in international schools and to present his research work in more than 100 conferences, universities, institutes and companies.

Published Work: He has authored and co-authored of 250 works in peer reviewed journals and he participated in 200 international congresses. Moreover, he published chapters in books, monographs & patents. For his published work he received more than 10k citations. (http://scholar.google.gr/citations?hl=el&user=-Pi-JS4AAAAJ&view_op=list_works&sortby=pubdate).

Membership/Organizations: Prof. Tsiakaras is executive member of the Greek Platform for Hydrogen & Fuel Cells as well as member of the Greek Platform of Biofuels, of the Hellenic Association for Heat and Power Cogeneration and of the Hellenic Catalysis Association. Moreover, he is member of the following international societies: ACS, Solid State Ionics, Electrochemical Society (ISE), Ionics, ASME, and Greek Society of Catalysis & Greek Society of Hydrogen. He is also (guest managing editor) of the Journal of Renewable Energy and executive member of the editorial board or active reviewer of more than 60 international scientific (Elsevier, ACS, RSC, Wiley, Springer etc) journals.

Administration: He served in various administrative positions at the Department of Mechanical Engineering and at the University of Thessaly (such as: chair of MEng Department and the Faculty of Engineering; coordinator of graduate & post graduate programs; since 2009 he is in charge of Career Office of UTH). He organized or was member of organizing committees of scientific conferences in National and International Conferences. He was member of PhD committees in European, USA and Asian Universities and proposals evaluation reviewer of EU and of other organizations.

Selected Publications

1. R Wu, P Tsiakaras, PK Shen, Facile synthesis of bimetallic Pt-Pd symmetry-broken concave nanocubes and their enhanced activity toward oxygen reduction reaction, Applied Catalysis B: Environmental 2019, 251, 49-56
2. S Jing, L Zhang, L Luo, J Lu, S Yin, PK Shen, P Tsiakaras, N-doped porous molybdenum carbide nanobelts as efficient catalysts for hydrogen evolution reaction, Applied Catalysis B: Environmental 2018, 224, 533-540
3. G Long, X Li, K Wan, Z Liang, J Piao, P Tsiakaras, Pt/CN-doped electrocatalysts: superior electrocatalytic activity for methanol oxidation reaction and mechanistic insight into interfacial enhancement, Applied Catalysis B: Environmental 2017, 203, 541-548
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Dimitris Valougeorgis

Professor

Analytical and Computational Mesoscale Methods in Transport Phenomena

Dr Valougeorgis received his Diploma from AUTh in 1980 and his M.Sc. and Ph.D. from the Virginia Polytechnic Institute and State University (VPI&SU, USA), in 1982 and 1985, respectively. During the next two years (1985-87), he was a visiting assistant professor at the Dept. of Mathematics and the Center for Transport Theory and Mathematical Physics of VPI&SU. He joined the faculty of the University of Thessaly (UTh) in 1998. Before joining UTh, he worked in Hellenic Petroleum in the Industrial Complex of Thessaloniki for almost 10 years.

Research Interests and Activities

Basic research interests include non-equilibrium flow and transport phenomena, kinetic theory, rarefied gas dynamics, numerical solution of integro-differential equations (Boltzmann and kinetic model equations), lattice Boltzmann methods and kinetic numerical approaches in CFD. Based on the above, applied research is performed in the fields of micro-electro-mechanical systems, vacuum technology including vacuum systems and pumps of fusion reactors, as well as in processes such as mixing, separation, evaporation, condensation and adsoption.

Recent research projects focus on the following areas:

(1) Greek National Program for Controlled Thermonuclear Fusion (Association Euratom – Hellenic Republic) funded by EUROfusion (EU) and the Greek Secretariat of Research and Technology (started in 2000 and renewed every year).

Kinetic solvers based on model equations for simulating the vacuum gas distribution systems of fusion reactors in the whole range of the Knudsen number are implemented. Efficient in-house hybrid solvers have been implemented to simulate steady-state and time-dependent gas pumping scenarios in ITER.

(2) Research and training network on miniaturized gas flow for applications with enhanced thermal effects – MIGRATE (funded by EU within HORIZON 2020: Marie Curie Innovative Training Networks, 2015-2019).

MIGRATE is an international training network consisting of 15 European partners (universities, research institutes, companies) for young researchers in the field of rarefied gas flows in Micro Electro Mechanical Systems (MEMS). Based on this program two students one from Spain and one from Iran are doing their Ph.D. degrees at the University of Thessaly.

(3) Industrial standards in the intermediate pressure to vacuum – 14IND06 pres2vac (funded by the European Metrology Programme for Innovation and Research, 2015-2018).

Pres2vac is an international research programme consisting of 16 partners (mostly European national metrology institutes plus some universities) and its aim is to enable the SI traceable measurement of absolute, positive and negative gauge pressure in the intermediate range from approximately 1 Pa to 10^4 Pa. The expertise of the Uth team in rarefied gas dynamics are implemented to support the development of piston gauges as primary and secondary pressure standards.

Selected Publications

Vargas, M., Naris, S., Valougeorgis, D., Pantazis, S., Jousten, K., Hybrid modeling of time-dependent rarefied gas expansion, *J. of Vac. Sci. & Tech. – A*, 32 (2), 021602, 2014.

Tatsios, G., Stefanov, S., Valougeorgis, D., Predicting the Knudsen paradox in long capillaries by decomposing the flow into ballistic and collision parts, *Phys. Review E*, 91, 061001(R), 2015.

Valougeorgis, D., Vargas, M., Naris, S., Analysis and guidelines on gas separation, conductance and equivalent single gas approach for binary gas mixture expansion through a short tube into vacuum, *Vacuum*, 128, 1-8, 2016.

Vasileiadis, N., Tatsios, G., Misdanitis, S., Valougeorgis, D., Modeling of complex gas distribution systems operating under any vacuum conditions: Simulations of the ITER divertor pumping system, *Fusion Engineering and Design*, 103, 125-135, 2016.

Tantos, C., Ghiroldi, G. P., Valougeorgis, D., Frezzotti, A., Effect of vibrational degrees of freedom on the heat transfer in polyatomic gases confined between parallel plates, *International Journal of Heat and Mass Transfer*, 102, 162-173, 2016.

Tatsios, G., Lopez-Quesada, G., Rojas-Cardenas, M., Baldas, L., Colin, S., Valougeorgis, D., Computational investigation and parametrization of the pumping effect in temperature driven flows through long tapered channels, *Microfluidics and Nanofluidics*, 21:99, 2017.

Tsimpoukis, A., Valougeorgis, D., Rarefied gas flow in a circular tube due to oscillating pressure gradient, *Microfluidics and Nanofluidics*, 22:5, 2018.

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Athanasios Ziliaskopoulos

Professor

Optimization of Production/Transportation Systems

Dr Ziliaskopoulos received his Diploma in Chemical Engineering from AUTh in 1984, his MS in Industrial Engineering in 1991 and PhD in 1994 from University of Texas at Austin. Prior to joining the department in 2003, he was the Luis Berger Associate Professor of Civil Engineering at the Northwestern University, USA. From 2010 to 2015 he was the Chairman of the Board and CEO of TRAINOSE, S.A.

Research Interests and Activities

Research interests include Network Equilibrium and Optimization Models (Dynamic and Stochastic, Optimum Path Algorithms (Online, Time Dependent and Stochastic), Information Technology, Control Systems (Reactive and Anticipatory), Logistics, Real-Time Traffic Management, and Freight Routing and Logistics.

Representative current research projects are :

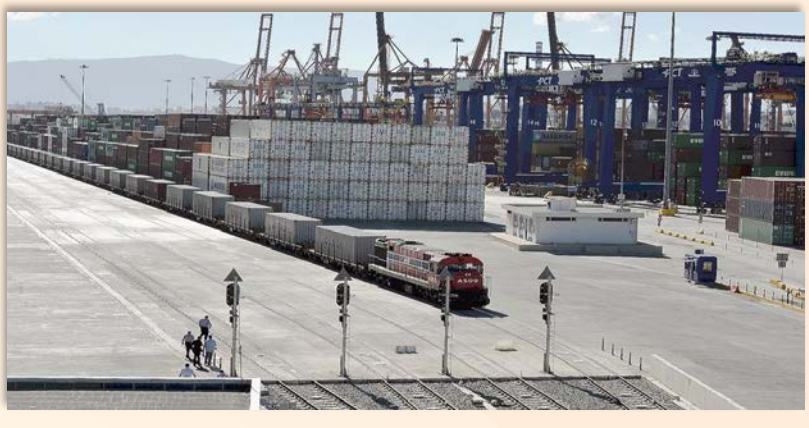
[1] "REDUCTION: Reducing Environmental Footprint based on Multi-Modal Fleet management System for Eco-Routing", Funded by FP7 – ICT, Project Lead Partner: Stiftung Universität Hildesheim, Total Budget € 3.772.860

[2] "NEAR2: Network of European – Asian Rail Research capacities", Funded by FP7-SST-2012-RTD-1, Project Lead Partner: CENTRE FOR RESEARCH AND TECHNOLOGY HELLAS - HELLENIC INSTITUTE OF TRANSPORT, Total Budget € 1.000.431,90, 1/2013 - 12/2014

[3] "GIFT: Green Intermodal Freight Transport", Funded by Interreg SEE, Project Lead Partner: Ministry of Development, Competitiveness, Infrastructure, Transport and Networks, Total Budget € 4.267.902,

[4] "ACROSSEE: Accessibility improved at border CROSsings for the integration of South East Europe", Funded by Interreg SEE, Project Lead Partner: Central European Initiative - Executive Secretariat, Total Budget € 3.025.246,64,

[5] Online Optimization and Control of Real-Time Systems (1998 –2003). Funding: National Science Foundation, CAREER Award.



Selected Publications

Chrisohou, E.,and A. Ziliaskopoulos (2017) On the Stochastic Inventory Routing Problem with Transshipment as a Recourse Action, *International Journal of Production Research* (submitted 31/10/2017)

Tuydes-Yaman, H. and Athanasios Ziliaskopoulos, (2014) Modeling demand management strategies, *Annals of Operations Research*, 217, 1 , pp 491-512

Ziliaskopoulos, A.K., Mandanas, F.D., Mahmassani H.S. *European Journal of Operational Research*, 198, 63-72, 2009.

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Peeta, S. and A. Ziliaskopoulos, Fundamentals of Dynamic Traffic Assignment: the Past, the Present and the Future. *Networks and Spatial Economics*, 1-2, pp 201-230, 2002.

Waller, S.T. and A.K. Ziliaskopoulos (2002),"On the Online Shortest Path Problem" *Networks,* 40:4 p. 182-202.

Ziliaskopoulos, A.K. (2000), "A linear programming model for the single destination system optimum dynamic traffic assignment problem," *Transportation Science, Vol. 34, pp. 1-12*.

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