LITHUANIAN ENERGY INSTITUTE

ADMISSION TO PHD STUDIES FOR THE YEAR 2026

DOCTORAL RESEARCH TOPIC:

Study of turbulent flow phenomena and interactions

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

Turbulence, despite its prevalence in nature and technology, remains one of the least understood areas of physics. This thematic area aims to help fill knowledge gaps and create more accurate turbulent flow models that would allow for more effective solutions to various engineering problems, such as the development of more efficient and safer energy solutions and the resolution of environmental issues. This is achieved by analysing flame-turbulence interaction in real-world situations, investigating flow structure in complex geometries, and applying experiments and state-of-the-art numerical methods to obtain new knowledge about the physics of turbulent flow, create more accurate models that would allow for the prediction of various engineering processes, and thus improve the efficiency and safety of engineering systems.

Several research topics are available within this doctoral theme:

1. Investigation of Turbulent Flow Behavior in Complex Geometries.

How do complex geometries (e.g., flow channels in nuclear power plants or heat exchangers) affect turbulent flow behaviour? This topic will use numerical methods (CFD) to investigate how flow velocity and the complex triple channel geometry change the internal order of the flow. Special attention is paid to turbulent mixing, vortex shedding, and the dynamics of coherent flow structures. Elucidating these phenomenological subtleties will allow for more accurate design of heat and mass transfer devices, thereby increasing system efficiency and safety.

Doctoral Thesis: Numerical investigation of flow regime influence on turbulent flow configuration and coherent structure dynamics in a triple channel. Supervisor: Dr. M. Povilaitis.

2. Artificial Intelligence: Predicting Flame Behaviour

Turbulence during combustion determines how quickly and dangerously a flame spreads. Since accurate combustion modelling requires substantial computational resources, this topic will utilise the power of artificial intelligence to create a fast and accurate Machine Learning model capable of replacing the slow parts of the turbulent combustion reaction source term in a CFD model. This would enable faster and more accurate modelling, applicable to combustion modelling, from nuclear and hydrogen safety scenarios to engine design, significantly improving the reliability and efficiency of predictions.

Doctoral Thesis: Development of a machine learning model for the turbulent combustion source term. Supervisor: Dr. M. Povilaitis.

3. Research on interfacial interactions

Topic Goal: The fundamental study of interfacial interaction aims to elucidate how critical boundary conditions and phase transitions induce abrupt changes in the flow regime.

Research Challenges:

- Investigation covers areas where conventional models are insufficient and the physical mechanisms of the processes are not fully understood.
- Spontaneous Turbulization: A positive feedback loop between heat and momentum transfer at the surfaces creates conditions for the spontaneous destabilization of laminar flow and transition to a turbulent regime.
- Condensation Implosion: A phenomenon where, due to a state of non-equilibrium in the vapor-liquid system, an exponential increase in mass and heat transfer occurs upon the excitation of turbulence.

You will conduct research aimed at proving whether:

- Local pressure differences of the condensing vapor exist above the water surface.
- These pressure differences cause micro-deformations of the water surface.

Doctoral Thesis: Flow regime changes induced by interfacial interaction. Supervisor: Dr. M. Šeporaitis.

SCIENTIFIC SUPERVISOR:

Dr. Mantas Povilaitis
Laboratory of Nuclear Installation Safety

Lithuanian Energy Institute
Breslaujos 3, 44403 Kaunas
Lithuania

Mantas.Povilaitis@lei.lt

More information and the full list of offered PhD topics available at our website

https://www.lei.lt/en/phd-studies/