LITHUANIAN ENERGY INSTITUTE

ADMISSION TO PHD STUDIES FOR THE YEAR 2026

DOCTORAL RESEARCH TOPIC:

Numerical study of the processes taking place in nuclear facilities

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

Nuclear energy can significantly contribute to the solution of the current energy problems in the EU and Lithuania, as it would positively contribute to security of supply, stability of energy prices and the achievement of carbon dioxide reduction goals. Therefore, research related to the safety of existing and new nuclear power plants (especially the emerging Small Modular Reactors (SMR)) remains relevant.

This topic is intended to solve problems related to the safety of generation III and III+ nuclear reactors, the design and safety assessment of SMR and Advance Modular Reactors. These problems are related to the application of new Accident Tolerant Fuel (ATF), passive safety systems, etc. This topic covers many scientific problems related to the modelling of coolant flows and heat exchange in nuclear fuel assemblies and reactor cooling systems. A separate PhD thesis can be appointed for the modelling features of natural circulation systems applied in SMR or numerical evaluation of aging processes of nuclear reactor component materials. The topic may also include the new installations' probabilistic assessment and extreme events risk research based on data science.

During the PhD work the processes in nuclear facilities will be analysed, selected experiments will be modelled, computer software capabilities will be evaluated and recommendations will be prepared for simulation of real processes. Deterministic and probabilistic analysis methods will be applied. Research conducted in this topic will contribute not only to increasing the safety of currently operating nuclear power plants, but also to the development and licensing of SMR.

Several dissertation topics are possible within this thematic area:

- "Analysis of process in the accident tolerant nuclear fuel rods under operational and transient conditions", scientific supervisor – dr. Tadas Kaliatka

ATF refers to a new generation of nuclear fuel and cladding materials that are designed to be more resistant to high temperatures and chemical reactions during transient conditions in a nuclear reactor (such as RIA or LOCA), compared with traditional zirconium fuel rods. The focus is on evaluating how different fuel microstructures and cladding materials in ATF concepts influence to thermohydraulic and thermomechanical performance under operational and transient conditions. In this topic, it is planned to use specialized computer programs to model ATF and compare calculations with available experimental data, with this validation of the computational code will be provided and recommendations for modelling will be prepared.

- "Research on the degradation mechanisms of nuclear reactor components under hydrogen impact", scientific supervisor – dr. Remigijus Janulionis

The aim of this PhD theme is the investigation of the impact of hydrogen on the material properties of nuclear reactor components. The study will propose a methodology for the numerical evaluation of this influence. This would enable the prediction of ageing processes caused by hydrogen impact, thereby improving the safety of both newly designed and currently operating nuclear reactors.

- "Study of the heat transfer in nuclear installations at coolant natural circulation condition", scientific supervisor – dr. Mindaugas Valinčius

In this topic, specialized computer programs will be used to simulate selected experiments and to assess the suitability of these programs for specific natural circulation regimes. Furthermore, an analysis of natural circulation regimes in nuclear facilities (passive safety systems) will be carried out, followed by the preparation of recommendations for modelling these processes.

- "New nuclear installations' probabilistic assessment and extreme events risk research based on data science", scientific supervisor – prof. dr. Robertas Alzbutas

The safety case and application plans for the new nuclear installations and their infrastructure and sites are closely linked to all postulated extreme events' assessment considering the frequency and their consequences. The objective is to investigate the reliability of new nuclear installations and perform the probabilistic assessment, reducing the uncertainty in the reliability and safety estimates and reducing the risk of extreme events when operational data availability is limited. In the work probabilistic assessment methodology for equipment and hazards' will be developed; uncertainty and risk minimization research and their modelling will be provided; significance of new equipment and extreme events will be determined and common methodology for safety estimates increase will be developed.

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