جامعة عبد المالك السعدي
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Université Abdelmalek Essaadi

Pole for Doctoral Studies
Center for Doctoral Studies Sciences, Technologies, and Medical Sciences

ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE

Ms. OULAD-BELAYACHI Soumaya

Will present here research work with the aim of earning a Doctorate

Doctoral program: Mathematical Sciences, Physics and New Technologies
Discipline: Physics
Specialty: Nuclear Physics

On 25/10/2025 at 16H30 at the Thesis Defense Hall, Faculty of Sciences of Tetouan, UAE
Under the Theme

Development of a Computer Code, OpenTHY, for the Thermal-Hydraulic Analysis of Research Reactors

Front of the jury composed of :

First Name & Last Name	Establishment	Designation
Pr. EL HAJJAJI Otman	FS of Tetouan, UAE	President
Pr. ESSAOUINI Hilal	FS of Tetouan, UAE	Reviewer
Pr. ACHAHBAR Abdelfattah	FS of Tetouan, UAE	Reviewer
Pr. CHAKIR El Mahjoub	FS of Kenitra, UIT	Reviewer
Pr. AZOUGAGH Mohamed	ENSAM of Rabat, UM5	Examiner
Pr. AZAHRA Mustapha	FS of Tetouan, UAE	Examiner
Dr. BOULAICH Yassine	CENM of Rabat, CNESTEN	Guest
Pr. MOUMNA Abdelhafid	FS of Tetouan, UAE	Co-Supervisor
Pr. EL BARDOUNI Tarek	FS of Tetouan, UAE	Supervisor

Host Research Structure: Artificial Intelligence and Computational Physics Laboratory,Radiation and Nuclear Systems Group, FS, Abdelmalek Essaadi University, Tetouan, Morocco

Abstract

Reducing greenhouse-gas emissions while meeting rising sustainable-energy demand positions nuclear energy as a key low-carbon solution. As interest in constructing new reactors and extending plant lifetimes grows, the demand for rigorous, thermal-hydraulic safety analysis across both power and research reactors has intensified. This thesis presents OpenTHY, an in-house thermal-hydraulic code for nuclear reactor analysis. The initial capability implements single and average channel models that are extensively verified and validated against the reference PARET/ANL code and experimental data across several power conditions.

Building on this foundation, OpenTHY was extended to cover full-core applications, providing subchannel-resolution predictions of safety critical parameters, fuel centerline temperature, coolant temperature, and the minimum departure from nucleate boiling ratio. Two representative reactors are investigated: the open-pool Moroccan TRIGA Mark II, for which a first detailed analysis at 1MW is performed based on a detailed MCNP model; and the pressurized-water SPERT-III E-core at 20MW, representative of commercial PWR thermal-hydraulic conditions. For the latter, a high-fidelity neutronic model is developed in OpenMC, derived from a recently updated IAEA benchmark, with particular attention to reproducing the initial conditions of the experimental transient Test 48 via negative reactivity insertion. Across both systems, OpenTHY reproduces measured data and benchmark calculations in good agreement, demonstrates adequate cooling performance under natural (TRIGA) and forced (SPERT) convection regimes. To broaden accessibility, a graphical user interface is developed to facilitate model setup, execution, and post-processing, enabling non-programmers to run, and analyze cases efficiently.

By coupling careful Validation and verification with pin-subchannel resolution and an open, extensible design, OpenTHY offers a reproducible, free alternative to commercial tool, strengthening the autonomy of academic and research institutions and improving confidence in safety limits through finer spatial fidelity. Overall, the validated framework establishes OpenTHY as a robust tool for high-fidelity thermal-hydraulic modeling and forthcoming transient studies.

Keywords : OpenTHY code, Thermal-hydraulic, Nuclear reactor, Safety analysis, TRIGA, SPERT III E-core, Graphical User Interface