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## Seminar

### Golden Horseshoe Branch

# The OSCAR System as a Research Platform and Industrial Support Tool for Research Reactor Core Analysis

**Speaker:** Dr. Rian Prinsloo and Dr. Francois van Heerden  
Radiation and Reactor Section, R&D Division, Necsa  
(South African Nuclear Energy Corporation)

**Date/Time:** Oct 6<sup>th</sup>, 1:30 – 3 pm.

**Location:** Engineering Technology Building (ETB), Room 534, McMaster University.

*Note:* The McMaster Nuclear Reactor Group are pleased to host Dr. Prinsloo & Dr. van Heerden. The Necsa Code Development Group are currently collaborating with staff from the McMaster Nuclear Reactor on tool and method development, validation and implementation. The work involves one PDF and multiple student projects.

#### Summary

The OSCAR nuclear reactor calculational software package has been incrementally developed over 30 years as both a research platform and industrial support tool. The current generation of the system OSCAR-4, is the primary calculational tool for the SAFARI-1 research reactor operated by Necsa in South Africa. The system also has an international usage footprint, and has been the primary calculational system for the R2 reactor at Studsvik, Sweden (before decommissioning), and currently is used at the HFR reactor at Petten in the Netherlands and the HOR reactor at TU-Delft in the Netherlands.

At heart of the system lies a nodal diffusion solver, coupled with a suite of various transport solvers for homogenized cross-section generation. This approach allows for highly efficient core and cycle analysis, while the extensive use of equivalence theory allow for retaining accuracy comparable to that of direct full core transport analysis.

The talk will have two parts: in the first a general overview of the code system is provided, with specific focus on capabilities and current research activities relevant to research reactor core analysis. In the second part, the talk will cover the longer term, next generation developments foreseen for OSCAR-5, specifically with regard to on-going research into possible solvers for OSCAR-5. **Continued on next page.**

In particular, a novel coarse grained particle transport algorithm, and its implementation on many core processing architectures, will be described. This next generation solver retains the general flexibility of a Monte Carlo method, but introduces an additional, deterministic scaling factor (the particle size), as well as other innovative techniques to address some of the issues typically encountered on assembly, and system level transport simulations.

**Dr. Prinsloo** has been working at the South African Nuclear Energy Corporation (Necsa) for 15 years, particularly in the fields of reactor physics and the development of computational methods in reactor analysis. He completed his PhD at the North West University in South Africa in Reactor Physics and since 2009 holds the position of Head of Method and Code Development of the OSCAR reactor core calculational system at Necsa. His research interest is in nodal diffusion based core calculational methods and their application to modern and legacy research reactor designs. Dr. Prinsloo is active in various international benchmarking efforts in this regard, as well as furthering the development of the OSCAR system for core design, core reload and core-follow analysis of research reactors.

**Dr. Francois van Heerden** is currently coordinating the code system development activities within the Radiation and Reactor Theory group at Necsa. He completed his PhD in mathematics at Utah State University in 2004, and his current research focus is on developing particle transport solution methods for modern high performance computing architectures. Dr. Van Heerden is also responsible for maintaining and improving the front end (cross section generation and homogenization) of the OSCAR system's calculational path.

**Coffee and Tea will be provided.**

**Please contact [sharpejr@mcmaster.ca](mailto:sharpejr@mcmaster.ca) if you have any questions.**