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Implementation of the RESKR module in NJOY

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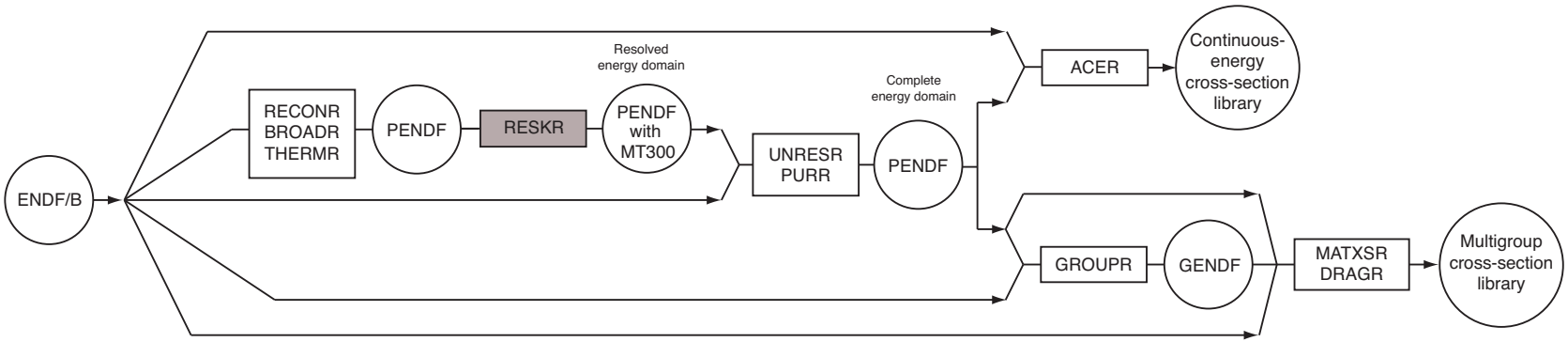
Table of contents

Introduction

- The Blackshaw-Murray elastic kernel represents the effect of neutron up-scattering caused by thermal motion of target nuclei and resonance elastic scattering on the multigroup scattering matrices.
- A first implementation of this model was proposed by Ouisloumen and Sanchez and made available in proprietary cross-sections libraries of the PARAGON and APOLLO lattice codes.
- Later, the same technique was reimplemented as module RESK in the NECP-Atlas cross-section generating code by J. Xu, T. Zu and L. Cao.
- Here, we propose an Open-Source implementation of the same module, renamed RESKR in NJOY-2012 and NJOY-2016.
  - The module RESKR in NJOY-2012 is based on the the Fortran source of module RESK in NECP-Atlas
  - The module RESK of NECP-Atlas was presented last Monday, 10:42.

Flow chart

- The new RESKR module implements the Blackshaw-Murray kernel according to the Ouisloumen and Sanchez formulas.
- An update of module GROUPR is also required. Subroutine `getrsk` retrieves Legendre-energy data corresponding to the resonance escape scattering kernel and available in the MT=300 reaction of the PENDF tape.



Conclusion

- The *resonant elastic scattering kernel* (RESK) model is an implementation of Blackshaw-Murray and Sanchez-Ouisloumen elastic kernel consistent with multigroup deterministic calculations.
- The RESK model is the deterministic equivalent of the *Doppler broadening rejection correction* (DBRC) method available in most Monte-Carlo codes.
- Availability of module RESKR is a long-standing request from NJOY community.
- The RESKR module in NJOY is based on the implementation of module RESK in the NECP-Atlas cross-section generating code.
- RESKR is an Open-Source contribution distributed under the BSD license.
- The actual implementation is a beta version requiring further validation. Collaboration is welcome.
- The source code is available at `http://merlin.polymtl.ca/pynjoy2012.htm`.

Ressources

- Academic:
  Alain Hébert (alain.hebert@polymtl.ca)
  Ahmed Naceur (ahmed.naceur@kinectrics.com)
- PyNjoy 2012 website:
  `http://merlin.polymtl.ca/pynjoy2012.htm`
- DRAGON5 website:
  `http://merlin.polymtl.ca/version5.htm`
- Textbook:
  Alain Hébert, Applied Reactor Physics,
  Presses Internationales Polytechnique,
  Third edition, Montréal, 2020.
  (to order)