Thesis Project Research Topics

Proposed Verification Methodology for Resonance Calculations in Gemma

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Supervised by: Dr Gustavo Alonso Vargas

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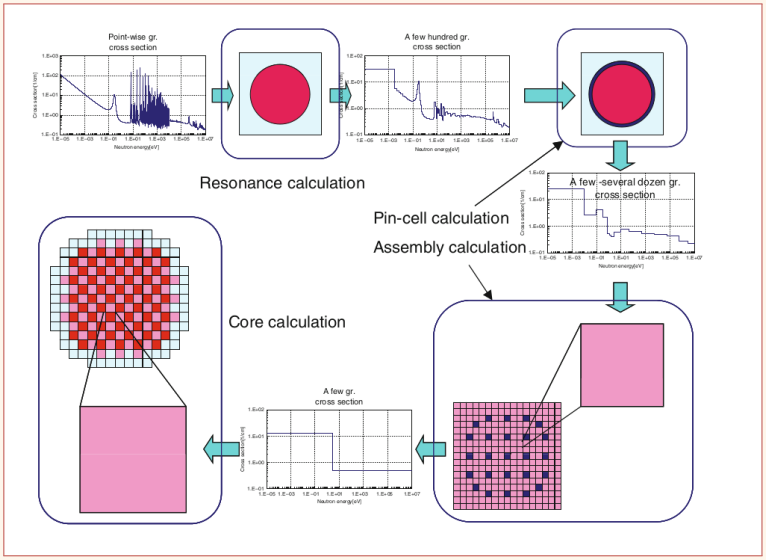


Image credit: Cacuci, D. G. (Ed.). (2010). Handbook of Nuclear Engineering: Springer Science & Business Media.

Multigroup Neutron Transport Equation

$$\Omega \cdot \nabla \psi_g(r,\Omega) + \sum_{iso} N_{iso}\sigma_{t,iso,g}(r)\psi_g(r,\Omega) = \sum_{g'=1}^{G}\int_{4\pi}\sum_{iso} N_{iso}\sigma_{s,iso,g'\to g}(r,\Omega'\cdot\Omega)\psi_{g'}(r,\Omega')\,d\Omega' + \frac{\chi_g(r)}{4\pi k}\sum\int_{4\pi}\sum_{iso} N_{iso}\nu\sigma_{f,iso,g'}(r)\psi_{g'}(r,\Omega')\,d\Omega' \quad (1)$$

Multigroup Definitions

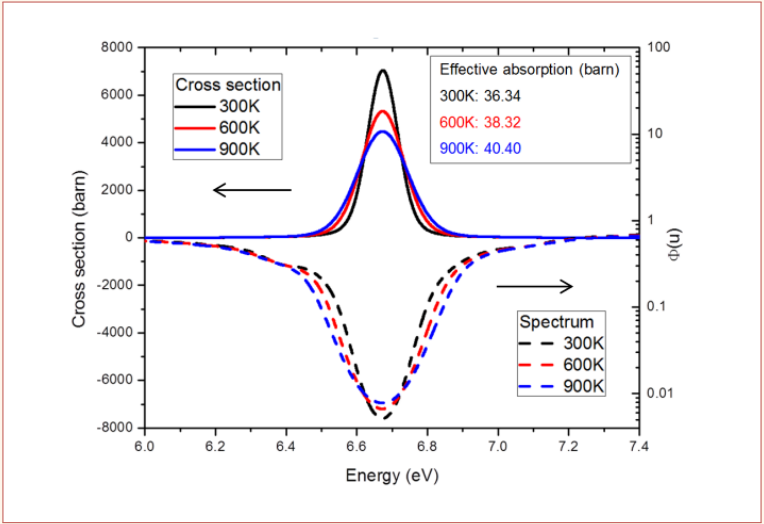
$$\psi_g(r,\Omega) = \int_{E_g}^{E_{g-1}} \psi(r,\Omega,E)\,dE \tag{2a}$$

$$\sigma_{x,iso,g}(r,\Omega) = \frac{\int_{E_g}^{E_{g-1}} \sigma_{x,iso}(r,E)\,\psi(r,\Omega,E)\,dE}{\int_{E_g}^{E_{g-1}} \psi(r,\Omega,E)\,dE} \tag{2b}$$

$$\sigma_{s,iso,g'\to g}(r,\Omega'\cdot\Omega) = \frac{\int_{E_g}^{E_{g-1}} \int_{E'_g}^{E_{g'-1}} \sigma_{s,iso}(r,\Omega'\cdot\Omega,E'\to E)\,\psi(r,\Omega,E')\,dE'\,dE}{\int_{E'_g}^{E_{g'-1}} \psi(r,\Omega,E')\,dE'} \tag{2c}$$

$$\chi_g(r) = \int_{E_g}^{E_{g-1}} \chi(r,E)\,dE \tag{2d}$$

Energy Self-Shielding



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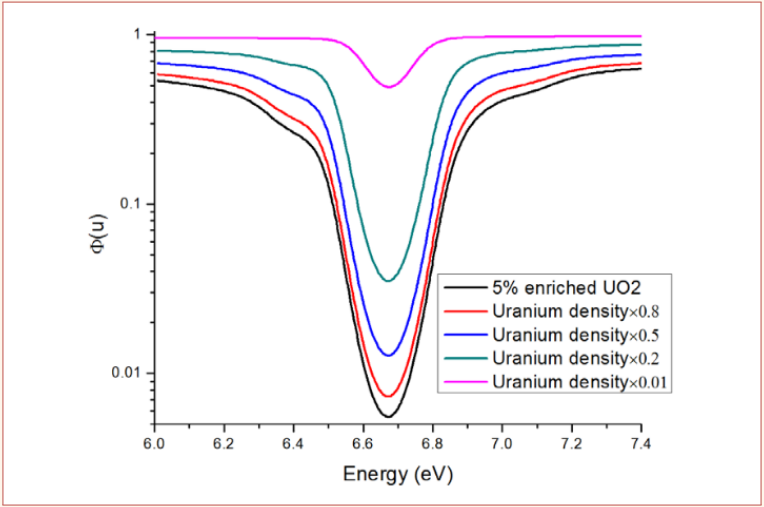
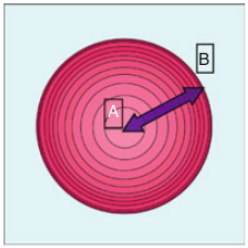
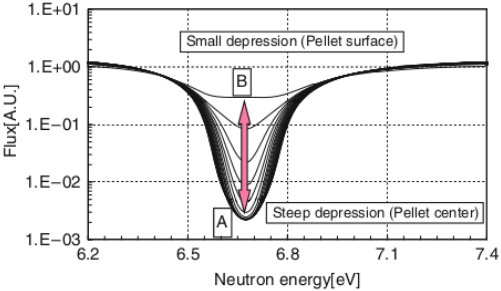


Spatial Self-Shielding





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  - Subgroup method

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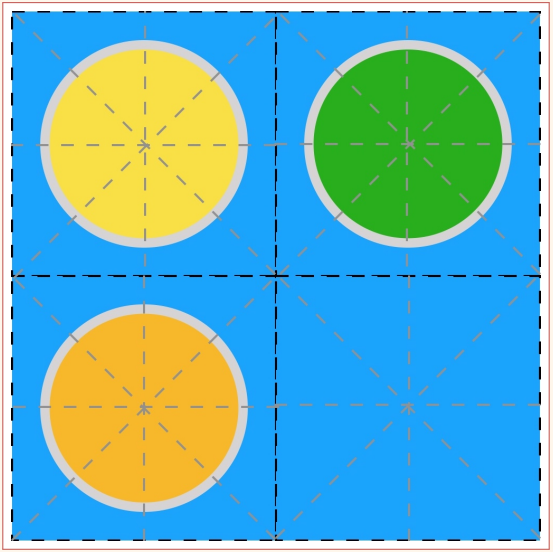

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   - *fully* Open Source

OpenMC Demo

- Cpp
- Python and Cpp API
- Jupyter-lab notebook

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  - Deterministic vs Stochastic methodology
- Library energy structure
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Thanks!
Questions?