

OECD/NEA Source Convergence Benchmark 4: Array of interacting spheres

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Overview

In this benchmark a lattice of $5 \times 5 \times 1$ separated highly enriched uranium metal spheres is considered. The separating material being the air. The center-to-center distance between spheres is 80 cm. All the spheres have the same composition (see Table 1). The radius of the central sphere is 10 cm while the radius of the other spheres is 8.71 cm. Figure 1 describes the overall geometry. The benchmark is an adaptation from Kadotani et al. (Proc. ICNC'91, Oxford, 1991)

Specifications

Material data

The fuel and air compositions are given in the following Table (in atoms/barn.cm):

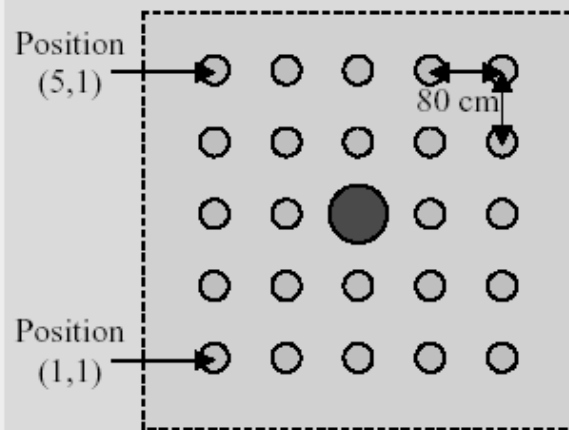
High enriched uranium metal	
U235	4.549E-02
U238	2.560E-03
Air	
N	4.3250E-5
O	1.0810E-5




Table 1

Geometry data

The following figure describes the problem geometry. The spheres are numbered as in a conventional matrix, so that the lowest left-hand sphere in the figure below is in position (1,1) and the top right-hand sphere is in position (5,5).

5 x 5 x 1 spheres



- | | | |
|--|--------------------|-----------------------|
|  | U_{metal} | $R = 8.71 \text{ cm}$ |
|  | U_{metal} | $R = 10 \text{ cm}$ |
|  | Air | |



Required calculations

Calculations are to be performed using the following parameters:

- **125** neutrons per generation
- **1000** active generations.

The source distribution of the **125** starting neutrons is the following:

- **101** neutrons in the **centre of the sphere (1,1)**,
- **1** neutron in the **centre of each of the other 24 spheres**.

Three different numbers of skipped generations (preceding the 1000 active generations) should be employed: **0, 200** and **400**.

For each number of skipped generations, **100** replicas will be run, using different random numbers sequences.

300 calculations are therefore required as follows:

Case	Random numbers sequence	Skipped Generations
1	#1	0
2	#1	200
3	#1	400
4	#2	0
5	#2	200
6	#2	400
...
298	#100	0
299	#100	200
300	#100	400