Neutron transport using S_N

Contents

1 Reed's problem

Reed's problem (William H. Reed (1971) New Difference Schemes for the Neutron Transport Equation, Nuclear Science and Engineering, 46:2, 309-314, DOI: 10.13182/NSE46-309) is a common test problem for transport codes. It is comprised of heterogeneous materials with strong absorber, vacuum, and scattering regions. These regions are valuable to testing different aspects of numerical discretizations.

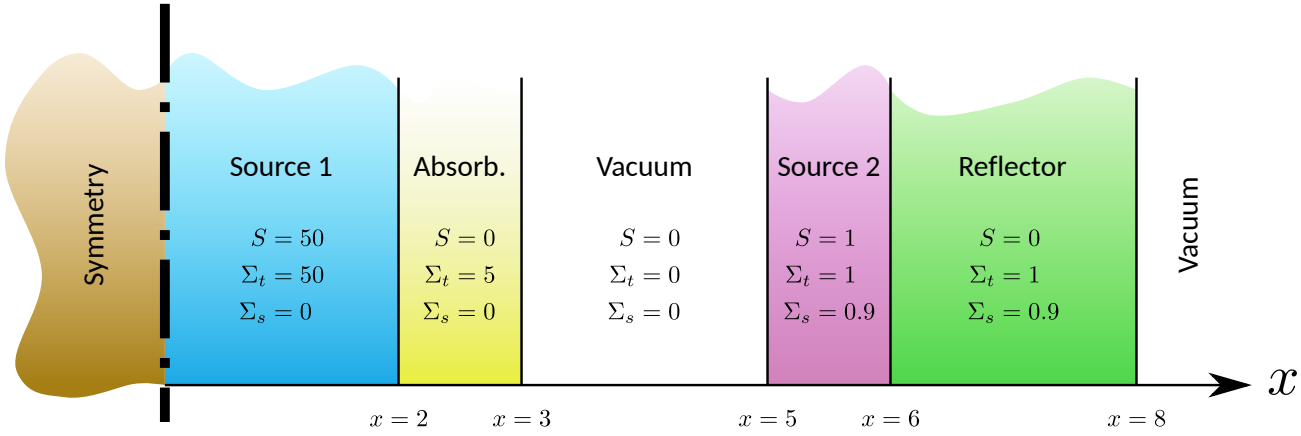

Figure 1: Geometry of the 1D Reed's problem (1971)

```
PROBLEM neutron_sn DIM 1 GROUPS 1 SN $1
READ_MESH reed.msh

MATERIAL source1       S1=50 Sigma_t1=50 Sigma_s1.1=0
MATERIAL absorber      S1=0  Sigma_t1=5  Sigma_s1.1=0
MATERIAL void          S1=0  Sigma_t1=0  Sigma_s1.1=0
MATERIAL source2       S1=1  Sigma_t1=1  Sigma_s1.1=0.9
MATERIAL reflector     S1=0  Sigma_t1=1  Sigma_s1.1=0.9

BC left  mirror
BC right vacuum

SOLVE_PROBLEM

PRINT_FUNCTION phi1
```

```
$ gmsh -1 reed.geo
$ [...]
$ for n in 2 4 6 8; do feenox reed.fee ${n} | sort -g > reed-s${n}.csv; done
$
```

The solutions obtained in FeenoX with S_2, S_4, S_6 and S_8 are plotted and compared against and independent solution from https://www.drryanmc.com/solutions-to-reeds-problem/.

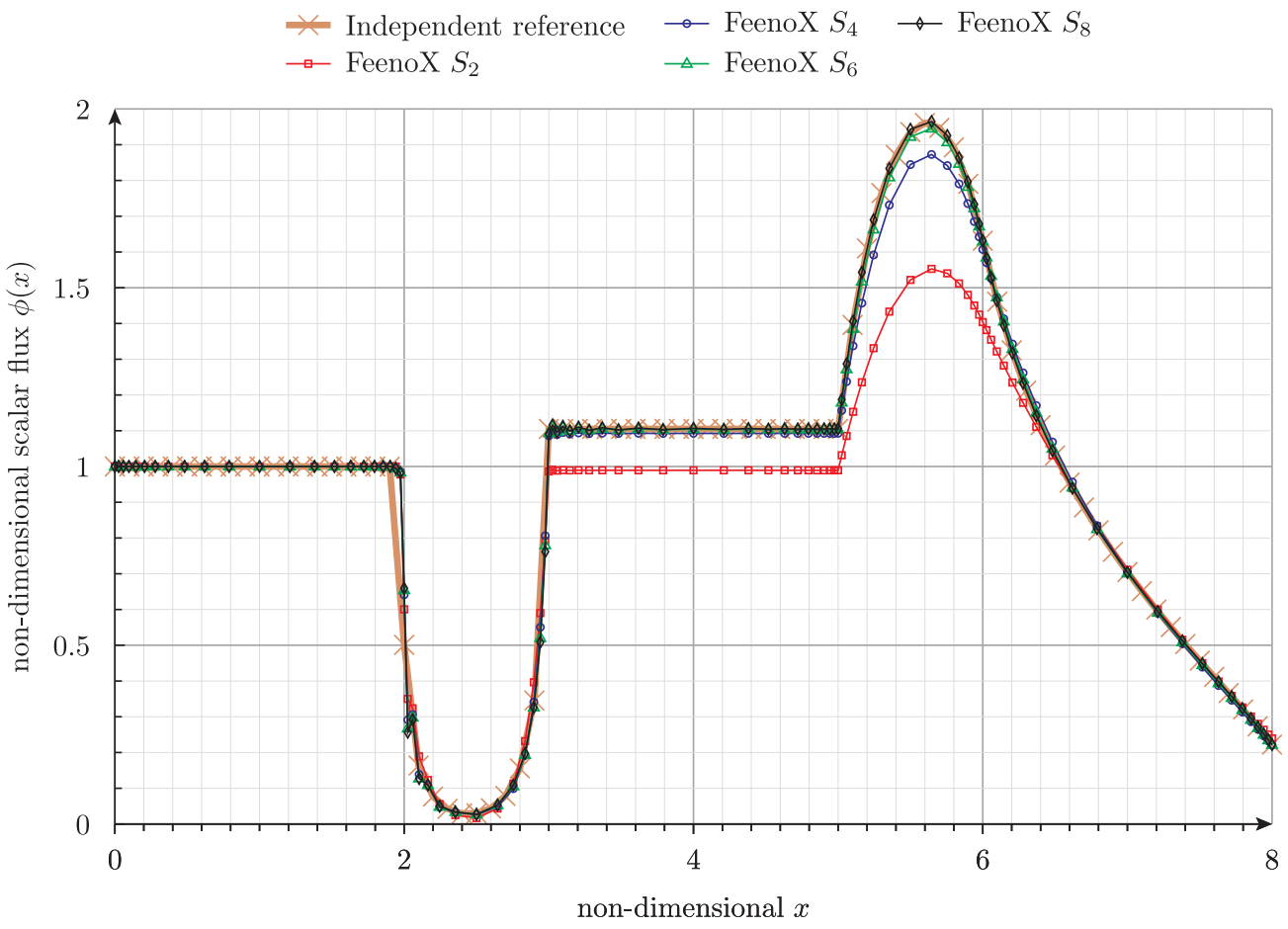

Figure 2: Solution of the Reed's problem