

Python script and mesh files documentation

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The python script `ice_scatterer.py` runs BEM++ to calculate the scattering matrix elements for scattering of an unpolarized incident wave by an ice crystal of fixed orientation. For this to run, the user must first download and install BEM++ from www.bempp.org and place the python script and the attached mesh files in their appropriate directories.

In this document, we briefly explain which mesh files correspond to the examples in the paper

The boundary element method for light scattering by ice crystals and its implementation in BEM++, which is also attached.

The mesh files were generated with Gmsh which may be downloaded at <http://geuz.org/gmsh/>

1 Sphere

Table 1 compares the accuracy of BEM++ for scattering by an ice sphere at different resolutions of the mesh. The table below shows which mesh file corresponds to which mesh resolution.

h	Mesh file name
$\lambda/2.5$	sphere-a-1-e-0.5.msh
$\lambda/5$	sphere-a-1-e-0.25.msh
$\lambda/10$	sphere-a-1-e-0.126.msh
$\lambda/20$	sphere-a-1-e-0.0628.msh
$\lambda/40$	sphere-a-1-e-0.0324.msh

The `.geo` file `sphere.geo` may be used to regenerate these mesh files (with adjusted parameters) in Gmsh.

2 Hexagonal column

Table 2 in the paper considers scattering by a hexagonal ice column of aspect ratio 2, with a mesh resolution of $\lambda/10$ for $ka = 5, 10, 15$.

ka	Mesh file name
5	hex-a-1-e-0.126.msh
10	hex-a-1-e-0.0628.msh
15	hex-a-1-e-0.0418.msh

The .geo file hex.geo may be used to regenerate these mesh files (with adjusted parameters) in Gmsh.

3 Hollow columns

Table 4 compares the scattering by hexagonal columns with cavities to the scattering by a solid hexagonal column. The aspect ratio of each column is 2.857. The size parameter for all three columns is $ka = 10$. The mesh resolution is $\lambda/10$.

Shape	Mesh file name
Solid column	hex-a-1-h-2p857-e-0.0628.msh
Regular cavity	cavity-a-1-e-0.0628.msh
Stepped cavity	cavityStep-a-1-e-0.0628.msh

The .geo files hex.geo, cavity.geo and cavity_stepped.geo may be used to regenerate these mesh files (with adjusted parameters) in Gmsh.

4 Bullet rosettes with 2 to 6 branches

Table 6 compares the scattering by bullet rosettes with 2 to 6 branches. The size parameter of each shape is $kA = 15$. Mesh resolution is $\lambda/20$.

No. of branches	Mesh file name
2	2branches-A-1-e-0.0209.msh
3	3branches-A-1-e-0.0209.msh
4	4branches-A-1-e-0.0209.msh
5	5branches-A-1-e-0.0209.msh
6	6branches-A-1-e-0.0209.msh

The .geo files 2branchesCube.geo, 3branchesCube.geo, 4branchesCube.geo, 5branchesCube.geo and 6branchesCube.geo may be used to regenerate these mesh files (with adjusted parameters) in Gmsh.