Input Geometry format

The geometry can be input either using an `hdf5` file format or a MATLAB struct stored as .mat format. The geometry is comprised of two half infinite half spaces, and a bunch of smaller components. The geometry is defined through a collection of vertices, curves and regions. Curves terminate, pass through or end at vertices, and regions are defined as the signed union of curves.

0.1 Types of curves

- `curvetype`=1: the curve is defined as the union of line segments
- `curvetype`=2: a sector of a circle passing through (a, y_0) and (b, y_0) with opening angle θ
- `curvetype`= 3: a sine curve with n half-wiggles passing through $(a, 0)$ and $(b, 0)$ and prescribed amplitude

$$(x(t), y(t)) = \left(a + (b - a) \cdot \frac{t}{n\pi}, Asin(t)\right) \quad t \in (0, n\pi)\,. \tag{0.1}$$

Note that for the last two curve types, the y components of the vertices must be identical. Support for rotated versions will be made available soon. See figure **??** for some illustrative curves.

There will also be two sem-infinite lines $(-\infty, 0) \to (a, 0)$ and $(b, 0) \to (\infty, 0)$ where $(a, 0)$ and $(b, 0)$ are specified by the user.

0.2 hdf5

The hdf5 file is structured as a collection of attributes for the geometry, a group called `curves` where each curve is a subgroup of the that group, and a group called `regions` where each region is a subgroup of that group.

0.2.1 Attributes

Attributes unless stated otherwise are mandatory.

- `ndomain`: Number of domains
- `ncurve`: Number of curves
- `verts`: (2,nverts), (x, y) coordinates of the vertices. The dataset must contain at least one vertex.
- `rnr`: (ndomain,1), real part of the refractive indices of each domain (optional, default value will be set to 1)
- `rni`: (ndomain,1), imaginary part of the refractive indices of each domain (optional, default value will be set to 0)

- `mode`: ‘te’ or ‘tm’, if unspecified or doesn’t match either of the two options, the default mode will be ‘te’ (optional).
- `lambda`: wavelength: Wavelength of the incident light
- `lvert`: verts(:,lvert) is the left vertex defining the negative half infinite line, i.e. the half line will extend from $(-\infty, 0) \to (\text{verts}(1, \text{lvert}), 0)$
- `rvert`: verts(:,rvert) is the right vertex defining the positive half infinite line, i.e. the half line will extend from $(\text{verts}(1, \text{rvert}), 0) \to (\infty, 0)$

0.2.2 Curves group

The `curves` group, has `ncurve` subgroups labelled $1, 2, \ldots$ `ncurve`. Each subgroup has the following attributes

Curve attributes

- `curvetype`: Current supported curvetypes are $1, 2$, or 3, see above.
- `curve_id`: Identifier for defining the curve, must be between $1, 2, \ldots$ `ncurve`.
- `vert_list`: For curve type 1, must be the list of vertices defining the union of line segments. For example, if `vert_list` $= [1, 4, 3]$ for curve type 1, then the curve would be defined as the line segments $\text{verts}(:, 1) \to \text{verts}(:, 4) \to \text{verts}(:, 3)$. If `curvetype` 2 or 3, vert_list must contain two vertices, the points (a, y_0) and (b, y_0) are given by $(a, y_0) = \text{verts}(:, \text{vert\_list}(1))$ and $(b, y_0) = \text{verts}(:, \text{vert\_list}(2))$
- `theta`: If `curvetype`=2, θ defines the opening angle (optional, if unspecified, it is set to pi/2).
- `ifconvex`: If `curvetype`=2, `ifconvex` = 0, implies the center of the circle is below the y coordinate of the prescribed points, and `ifconvex` = 1, implies the center of the circle is above (optional, if unspecified `ifconvex` =0).
- `nwiggles`: If `curvetype`=3, `nwiggles` = n above (optional, if unspecified, `nwiggles` = 1).
- `amplitude`: If `curvetype`=3, `amplitude` = A above (optional, if unspecified, `amplitude` = 1).

0.2.3 Regions group

The `regions` group, has `ndomain` subgroups labelled $1, 2, \ldots$ `ndomain`. Each subgroup has the following attributes

Region attributes

- abs

0.3 MATLAB struct

0.4 Example