Shooting a cone of rays

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Complete ray tracing program `CRT` offers many different initial conditions for rays. Recently, the possibility to specify arbitrarily rotated spherical coordinates for point sources has been coded. The rotation may be either common to all the point sources of the computation, or may be specified for each source separately. The second option thus enables the user to shoot cones of rays from the given point sources, and to individually specify the direction of cones for each source. Note that the normalized ray parameter domain is always rectangular, and that the ray parameters which correspond to the normalized ray parameters are specified in the left bottom, the right bottom and the left top corners of the normalized ray domain. Thus the expression "cone of rays" is not exact, but we shall keep it for its simplicity.

If the user selects to parameterize the point source by an azimuthal equidistant projection of a unit sphere, the cone of a regular grid of initial rays may be traced. If the user further selects a "rectangular" initial–value shooting, the cone covered regularly and rectangularly by initial–value rays is traced.

To demonstrate this new option of the `CRT` program, a simple history file `len-cone.h` has been prepared to trace a cone of rays in the model `MODEL=len-mod.dat` with a lenticular inclusion. In the history file, we specify `INIPAR=3` to parameterize the point source by the azimuthal equidistant projection of a unit sphere, we specify `INIDIR=1` to select rotated initial parameters with the rotation vector specified for each source individually. File `SRC` thus must contain, for each point source, a directional vector specifying the initial direction of the local coordinate system. File `SRC=lenc-src.dat` contains a single initial point with the coordinates `[24, -5, -15]` and the directional vector `(1, 1, 1)`. The point source is thus located under the lenticular inclusion, and the initial direction of the cone of rays is "diagonal". In the data for ray parameters `RPAR=lenc-rpa.dat`, we specify `ISRFX1=-1` and `ISRFX2=0` to choose the one–parametric shooting, which includes the "rectangular" shooting, and we specify `IPOINT=0` to choose the initial–value ray tracing. We also specify the ray domain `PAR1L=-0.1, PAR2L=-0.1, PAR1A=0.1, PAR2A=-0.1, PAR1B=-0.1, PAR2B=0.1` and the net of basic rays `ANUM=5, BNUM=5`. We thus shoot a regular rectangular cone of six times six initial–value rays. The numerical parameters for the calculation of the rays `DCRT=len-crt.dat` are common with the two–point ray tracing calculation performed by history file `len-crt.h`, a single refracted wave `CODE=codep.dat` is traced.

The calculated rays are added to the `VRML` and `GOCAD` files with the structural interfaces, see Figures 1 and 2.

Acknowledgements

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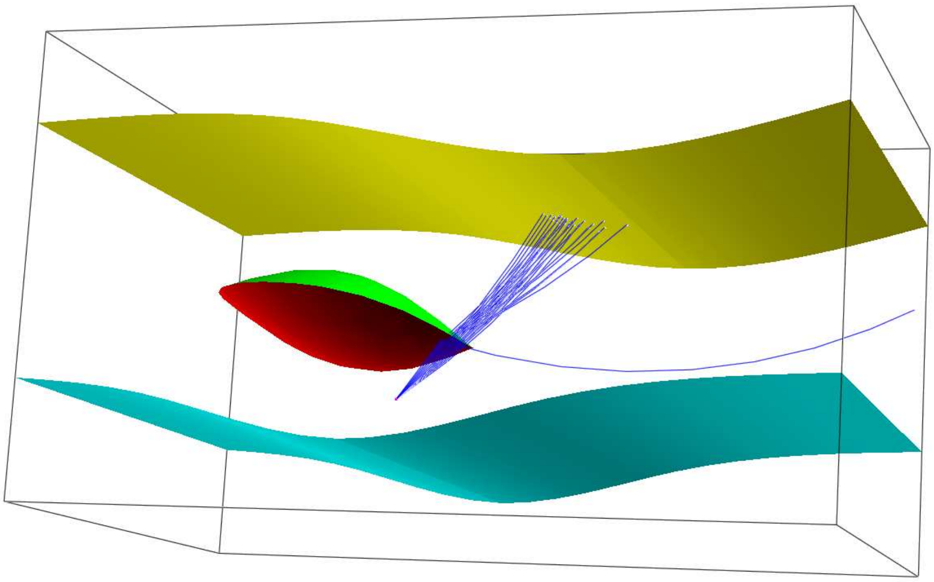

Figure 1: `GOCAD` snapshot of the interfaces in the model with lenticular inclusion, and of the cone of rays calculated by history file `len-cone.h`. If we look to the rays as they leave the point source, we can see, from the right–hand side to the left–hand side, the rays that do not interact with the lens, then the rays that overcritically hit the bottom of the lens and terminate here (hard to see in this picture), then a single ray weakly refracted at the bottom of the lens (the ray that terminates at the right–hand side of the model), and the rays refracted through the lens, that leave the source as the left–most rays and terminate at the top of the model as the right–most rays.

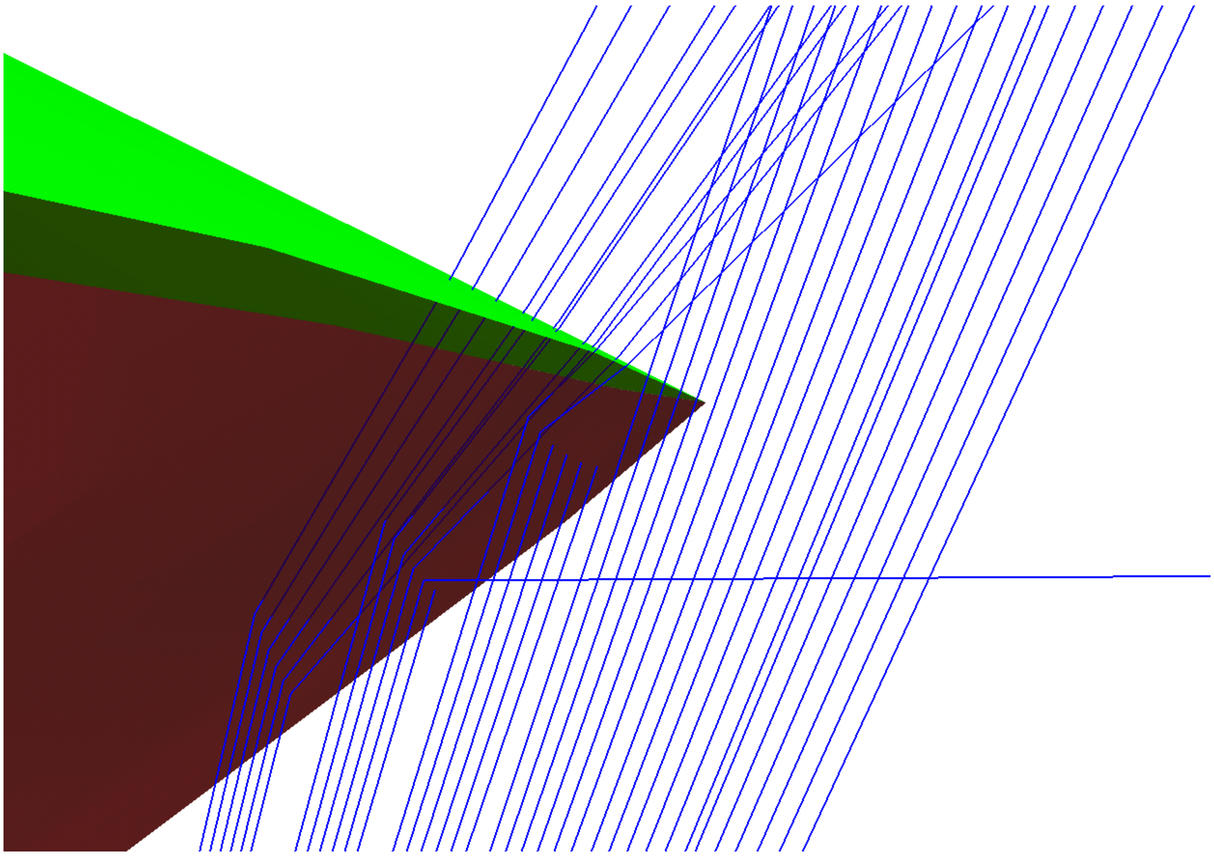

Figure 2: Detail of the Figure 1. The bottom surface of the lenticular inclusion is partially transparent.