INFOMGP - GAME PHYSICS

EXERCISES LECTURE 6

EXERCISE 6.1

Find a support point for the following objects for the given direction d.

i) A box with dimensions $(4, 2, 6)$ centered at $(-2, 1, 6)$ with $d = (-2, 1, 6)$

ii) A triangle consisting of the vertices $(-8, -2)$, $(4, -2)$ and $(4, 6)$ with $d = (1, 0)$

iii) A sphere of radius 1.2 with its center at $(1, 1, 1)$ with $d = (-1, 2, 2)$

i) The support mapping is given by $S_{box}(v) = c + \left(sign(d_x)e_x, sign(d_y)e_y, sign(d_z)e_z\right)$ where the size of the box is $2e_x \times 2e_y \times 2e_z$.

Here we have $S_{box}(v) = \begin{pmatrix} -2 \\ 1 \\ 6 \end{pmatrix} + \begin{pmatrix} (-1) \times 4/2 \\ (1) \times 2/2 \\ (1) \times 6/2 \end{pmatrix} = \begin{pmatrix} -4 \\ 2 \\ 9 \end{pmatrix}$

Therefore a support point of the box is $(-4, 2, 9)$.

ii) To find the support point in the x-direction, we just have to select the vertex with maximal x coordinate. Here both the second and third have a maximal value (4). So both can be selected as a supporting point.

iii) The support mapping is given by $S_{sphere}(d) = c + r\frac{d}{\|d\|}$

Here we have $S_{sphere}(d) = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} + \frac{1.2}{\|(-1,2,2)\|}\begin{pmatrix} -1 \\ 2 \\ 2 \end{pmatrix} = \begin{pmatrix} 0.6 \\ 1.8 \\ 1.8 \end{pmatrix}$

Therefore a support point of the sphere is $(0.6, 1.8, 1.8)$.