

◇ V.1

Computing the Intersection of a Line and a Cone

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◇ Introduction ◇

Computing the intersection of a line and an object is a common operation in computer graphics, for example, when ray tracing. Computation of the intersection of a line and a cylinder has been treated in previous gems (Cychosz and Waggenspack 1994, Shene 1994). This gem extends the latter work by computing the intersection of a line and a cone through geometric means.

◇ Definitions ◇

The notation and defining formulas are presented for three geometric objects:

- $\ell(\mathbf{B}, \mathbf{d})$: the line defined by base point \mathbf{B} and direction vector¹ \mathbf{d} .
- $\mathcal{P}(\mathbf{B}, \mathbf{n})$: the plane defined by base point \mathbf{B} and normal vector \mathbf{n} .
- $\mathcal{C}(\mathbf{V}, \mathbf{v}, \alpha)$: the cone defined by vertex \mathbf{V} , axis direction \mathbf{v} , and cone angle α .

In these definitions, bold-face roman type indicates a vector quantity. Moreover, upper (lower)-case vectors are position (direction) vectors. Position vectors are sometimes referred to as points. Therefore, \mathbf{P} and P are equivalent. The normalized cross product $\mathbf{u} \otimes \mathbf{v} = \mathbf{u} \times \mathbf{v} / \|\mathbf{u} \times \mathbf{v}\|$ is also employed.