

Cylindrical and Spherical Coordinates

The following are conversion formulas between rectangular (x, y, z) , cylindrical (r, θ, z) and spherical (ρ, θ, ϕ) coordinates.

Between rectangular and cylindrical coordinates:

$$\begin{aligned}x &= r \cos \theta & r^2 &= x^2 + y^2 \\y &= r \sin \theta & \tan \theta &= \frac{y}{x} \\z &= z & z &= z\end{aligned}$$

Between cylindrical and spherical coordinates:

$$\begin{aligned}r &= \rho \sin \phi & \rho^2 &= r^2 + z^2 \\ \theta &= \theta & \theta &= \theta \\z &= \rho \cos \phi & \phi &= \arccos \frac{z}{\sqrt{r^2 + z^2}}\end{aligned}$$

Between rectangular and spherical coordinates:

$$\begin{aligned}x &= \rho \sin \phi \cos \theta & \rho^2 &= x^2 + y^2 + z^2 \\y &= \rho \sin \phi \sin \theta & \tan \theta &= \frac{y}{x} \\z &= \rho \cos \phi & \phi &= \arccos \frac{z}{\sqrt{x^2 + y^2 + z^2}}\end{aligned}$$