Table 2
Coordinate Syatem Conversion Formulas

Coordinate System	**Scalar Conversions**	**Vector Conversions**
Cylindrical (r,ϕ,z)	x=r$\cos\phi$ y=r$\sin\phi$ z=z	$u_x = \cos\phi u_r - \sin\phi u_\phi$ $u_y = \sin\phi u_r + \cos\phi u_\phi$ $u_z = u_z$
	r=$\sqrt{x^2+y^2}$ $\phi = \tan^{-1}(y/x)$ z=z	$u_r = \cos\phi u_x + \sin\phi u_y$ $u_\phi = -\sin\phi u_x + \cos\phi u_y$ $u_z = u_z$
Spherical (R,θ,ϕ) ($0 \le \theta \le \pi$)	x=R$\sin\theta\cos\phi$ y=R$\sin\theta\sin\phi$ z=R$\cos\theta$	$u_x = \sin\theta\cos\phi u_R + \cos\theta\cos\phi u_\theta - \sin\phi u_\phi$ $u_y = \sin\theta\sin\phi u_R + \cos\theta\sin\phi u_\theta + \cos\phi u_\phi$ $u_z = \cos\theta u_R - \sin\theta u_\theta$
	R=$\sqrt{x^2+y^2+z^2}$ $\phi = \tan^{-1}\left(\frac{\sqrt{x^2+y^2}}{z}\right)$ $\phi = \tan^{-1}(y/x)$	$u_R = \sin\theta\cos\phi u_x + \sin\theta\sin\phi u_y + \cos\theta u_z$ $u_\theta = \cos\theta\cos\phi u_x + \cos\theta\sin\phi u_y - \sin\theta u_z$ $u_\phi = -\sin\phi u_x + \cos\phi u_y$