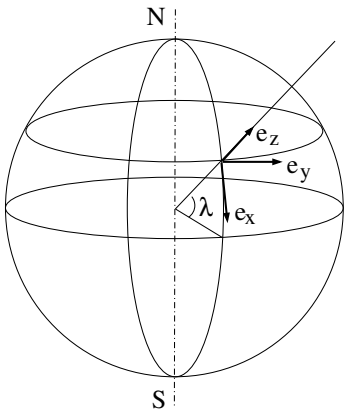
[mex66] Effect of Coriolis force on range of projectile

Consider a location at northern latitude λ on the Earth's surface. A particle is projected due east with initial speed v_0 and angle of inclination α above the horizontal. Show that the change in the range $R = (2v_0^2/g)\sin\alpha\cos\alpha$ of the projectile due to the Coriolis force is

$$\Delta R = \sqrt{\frac{2R^3}{g}}\omega\cos\lambda\left[\cot^{1/2}\alpha - \frac{1}{3}\tan^{3/2}\alpha\right].$$

Perform the calculation to leading order in ω, the angular frequency of the Earth's rotation.



Solution: