1 Effect of the Coriolis Force on an Artillery Projectile

1.1 Lateral Deflection

A projectile is fired due east with an angle of inclination to the horizontal of α and initial speed v_0. This takes place on the northern hemisphere at a latitude of λ. Show that the southward (lateral) deflection of the projectile can be approximated as

$$d = \frac{4v_0^3}{g^2}\,\omega \sin\lambda\, \sin^2\alpha\, \cos\alpha \tag{1.1}$$

where g is the acceleration due to gravity near the surface of the earth, and ω is the angular frequency of rotation of the earth. Neglect air resistance.

1.2 Is this an Important Effect for Artillery?

A howitzer has a muzzle velocity of about 680 m/s. If it fires a projectile due east with an angle of inclination of 45° and at a latitude of 45°, what will be the range, R, of this projectile and the southward deflection projectile, d?

2 Effect of the Coriolis Force on a Projectile Going Straight Up and Down

A projectile is fired straight up and reaches a maximum height of h. This takes place on the northern hemisphere at a latitude of λ. **(a)** Show that the projectile lands distance of approximately

$$d = \frac{8}{3}\sqrt{\frac{2h^3}{g}}\omega\, \cos\lambda \tag{2.1}$$

from where is was launched, where g is the acceleration due to gravity, and ω is the angular frequency of rotation of the earth. Neglect air resistance. **(b)** What is the direction that the projectile is deflected.