Fundamental Journal of Mathematical Physics
Vol. 3, Issue 2, 2013, Pages 51-54
Published online at http://www.frdint.com/

HOW TO ELIMINATE GRAVITY EFFECT FROM A MOVING BODY NEAR THE EARTH SURFACE

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Abstract

Moving bodies near the earth surface will get the force attracting them to downward as big as acceleration of gravity (g). Theoretically, based on derivation from [1], we can eliminate gravity effect from a moving body near the earth surface by setting the velocity and the trajectory.

1. Introduction

Generally, on celestial mechanics, the trajectory of the planets is ellipse. The only force attracting those planets in order to stay in their orbits is gravity. On the other hand, the unique problem emerges when the trajectory of a moving body near the earth's surface is ellipse. This geometry makes gravity effect disappear.

In this paper, we set radius, $r << r_e$, in which $r_e =$ earth radius from the center. In the third article, we set $r = \ell_p$ in which ℓ_p is the Planck length. Both the second and the third papers, are derived from the same equation (see [1]).

2. Theoretical Review

Based on [1], Arisetyawan has derived a formula from semicircular motion on the earth surface as follows:

Keywords and phrases: gravity effect, moving body, earth surface.

Received March 28, 2013

$$y = (\tan\alpha)x - 0.5\left(\frac{v^2\cos(90-\theta)}{v_0{}^2\cos^2\alpha r} + \frac{g\sin^2(90-\theta)}{v_0{}^2\cos^2\alpha}\right)x^2. \tag{1}$$

Equation (1) is semicircular trajectory on two-dimensional axis. How to get this formula (see [1]). Now, we will eliminate gravity effect (g) from (1) by setting $\theta = \frac{\pi}{2}$ for all time *t*.

Thus,

$$y = (\tan\alpha)x - 0.5\left(\frac{v^2}{v_0{}^2\cos^2\alpha r}\right)x^2 \tag{2}$$

a glimpse, equation (2) is similar with parabolic trajectory, but the coefficient of x^2 is not constant for all time *t*.

We will prove that the coefficient of (2) is not constant as follows:

For:

$$t = 1,\ \omega = \frac{\pi}{2}\,rad/s,\ \text{and}\ \theta = \frac{\pi}{2}\,rad,$$

$$t = 2,\ \omega = \frac{\pi}{4}\,rad/s,\ \text{and}\ \theta = \frac{\pi}{2}\,rad,$$

$$t = 3,\ \omega = \frac{\pi}{6}\,rad/s,\ \text{and}\ \theta = \frac{\pi}{2}\,rad.$$

So that, for $t = T$,

$$\omega = \frac{\pi}{2T}\,rad/s. \tag{3}$$

From the relation between linear and angular velocity, we have

$$v = \omega r, \tag{4}$$

$$v = \frac{\pi}{2T}r. \tag{5}$$

From (5), we know that linear velocity is also not constant. The boundary condition for $T = 0$, we set $v = v_0 = c$, in which c is the speed of light, we knew that in special relativity, there are no moving bodies in this universe faster than light.

Now, we will prove that (2) is an ellipse. By considering (2) as parabolic equation, we have equations for symmetrical axis and maximum height as follows:

$$x_s = \frac{v_0^2 \sin 2\alpha}{2\frac{v^2}{r}} = \frac{v_0^2 \sin 2\alpha}{2a_s}, \tag{6}$$

$$y_{\max} = \frac{v_0^2 \sin^2 \alpha}{2\frac{v^2}{r}} = \frac{v_0^2 \sin^2 \alpha}{2a_s}. \tag{7}$$

Based on (5), equations (6) and (7) mean that the maximum point is not unique because a_s is not constant. It means the trajectory will pass through all maximum points. By using analogue steps in previous paper (see [4]), but it is a different case and we can rewrite (6) and (7) as follows:

$$\sin 2\alpha = \frac{x_s}{v_0^2/2a_s}, \tag{8}$$

$$y_{\max} = \frac{v_0^2 2\sin^2 \alpha}{4a_s} = \frac{-v_0^2(\cos 2\alpha - 1)}{4a_s}, \tag{9}$$

$$\cos 2\alpha = -\frac{y_{\max} - v_0^2/4a_s}{v_0^2/4a_s}. \tag{10}$$

By using trigonometry properties:

$$\sin^2 2\alpha + \cos^2 2\alpha = 1, \tag{11}$$

$$\frac{(x_s)^2}{(v_0^2/2a_s)^2} + \frac{(y_{\max} - v_0^2/4a_s)^2}{(v_0^2/4a_s)^2} = 1, \tag{12}$$

$$\frac{(x_s)^2}{(c)^2} + \frac{(y_{\max} - d)^2}{(d)^2} = 1. \tag{13}$$

Equation (13) is an ellipse at the center $(0, d)$.

From (13), we have

$$x_s = \pm c\sqrt{1 - \frac{(y_{\max} - d)^2}{(d)^2}}, \tag{14}$$

$$x_s = \pm \frac{c}{d}\sqrt{-(y_{\max})^2 + 2dy_{\max}}. \quad (15)$$

The following condition for $y_{\max}$ is

$$0 \leq y_{\max} \leq 2d,$$

$$0 \leq y_{\max} \leq v_0^2 / 2a_s .$$

From (15), taking the positive value, we have a semi-ellipse equation as follows

$$x_s = \frac{c}{d}\sqrt{-(y_{\max})^2 + 2dy_{\max}}. \quad (16)$$

If we set $x_s = y'$ and $y_{\max} = x'$, thus (16) can be written in a new transformation as follows:

$$y' = \frac{c}{d}\sqrt{-(x')^2 + 2dx'}. \quad (17)$$

Equation (17) is equivalent with (2). Both of them are semi-ellipse in different coordinates.

3. Result and Discussion

From equation (1), by setting the angle, we can get different trajectories. For example, if we set $\theta = 0$ for all time t, the trajectory will be parabolic.

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