Advitiy - Tether simulations

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Contents

1 Introduction:

This document deals with day to day work on simulations of satellite deorbiting.

2 Setting B = 0:

May 5, 2017

Simulation was tried with magnetic field set to zero. Theta and phi results were as expected. Graph of r is yet to explain. Though the changes in r are very small ($O(10^{-8})$), it would be expected that the initial point would be an apogee or a perigee. Therefore simulation was performed again to get a graph of rdot (checkout the *debugging_r* branch)

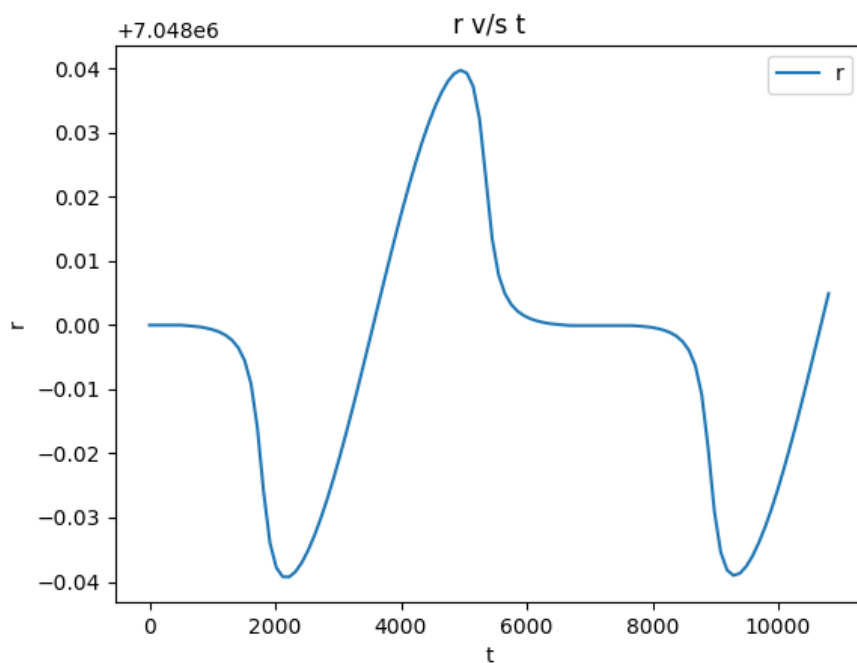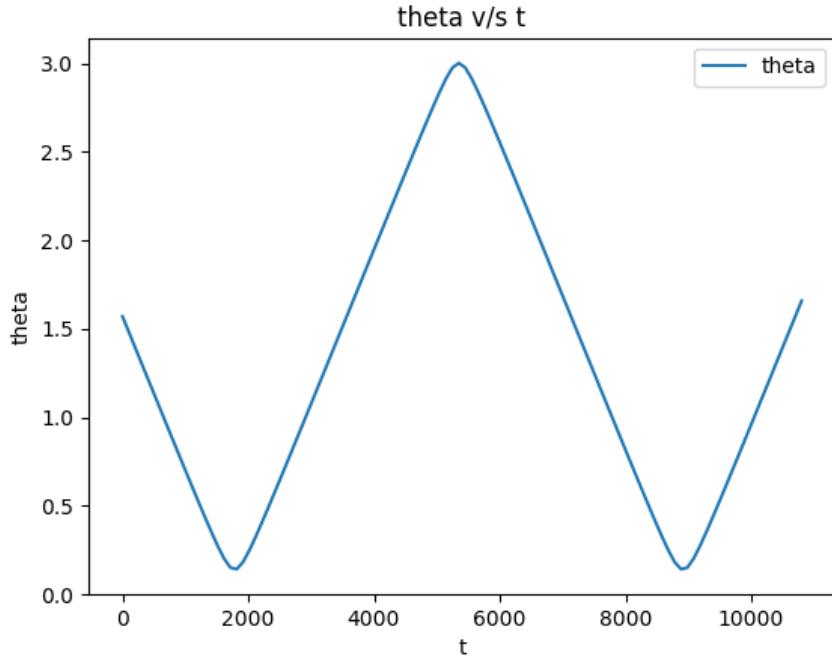Figure 1: Variation of satellite distace from centre of earth with time

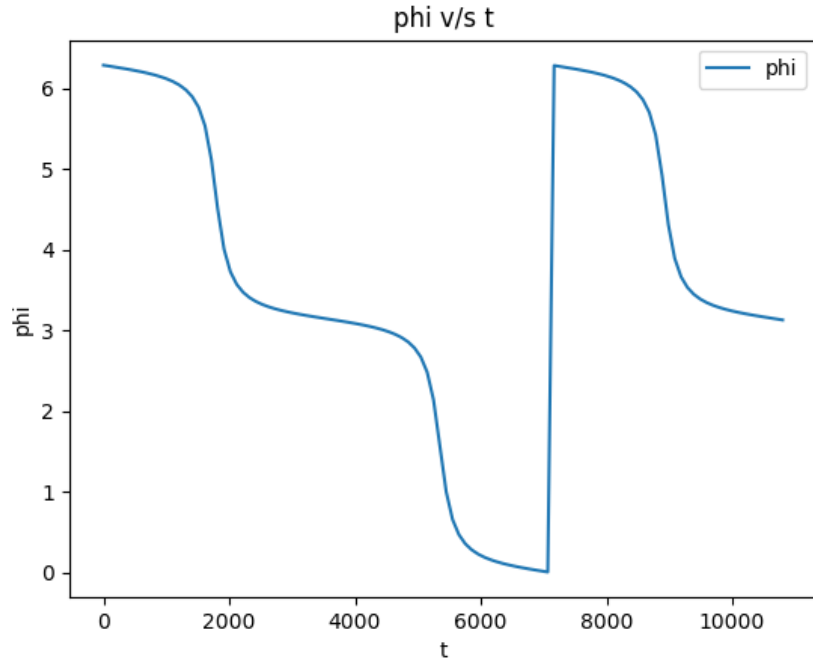Figure 2: Variation of co-latitude from centre of earth with time

Figure 3: Variation of phi from centre of earth with time

V_r graph is weird. Yet to be explained

Initially it was felt that these numerical errors could be reduced by using v_θ, v_ϕ instead of $\dot{\theta}, \dot{\phi}$ since v_θ, v_ϕ are of the same order as v_r. But the value of r kept on increasing on doing so. Behavior yet to be explained

3   Setting B accordng to IGRF model:

May 5, 2017

Simulation for 2 days. (Run time ~8 hrs)

3.1   Assumptions:

- No orbital perturbations due to oblateness of the earth

- Current in the tether equal to the current induced in radial direction

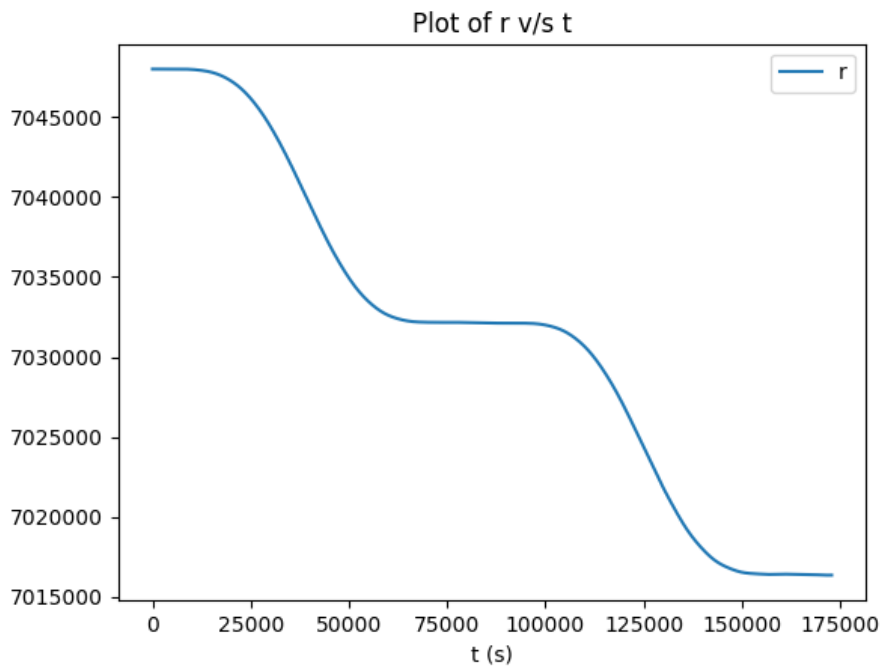- Tether always pointing downwards.

3.2   Results:

Figure 4: Variation of satellite distace from centre of earth with time

Initially the satellite orbit is very close to magnetic axis. So derobitting rate is small. After about half a day, magnetic makes largest angle with orbit, thus deorbiting rate is highest and starts decreasing again. Smae behaviour repeated for the next day. An average of about 15km/day.
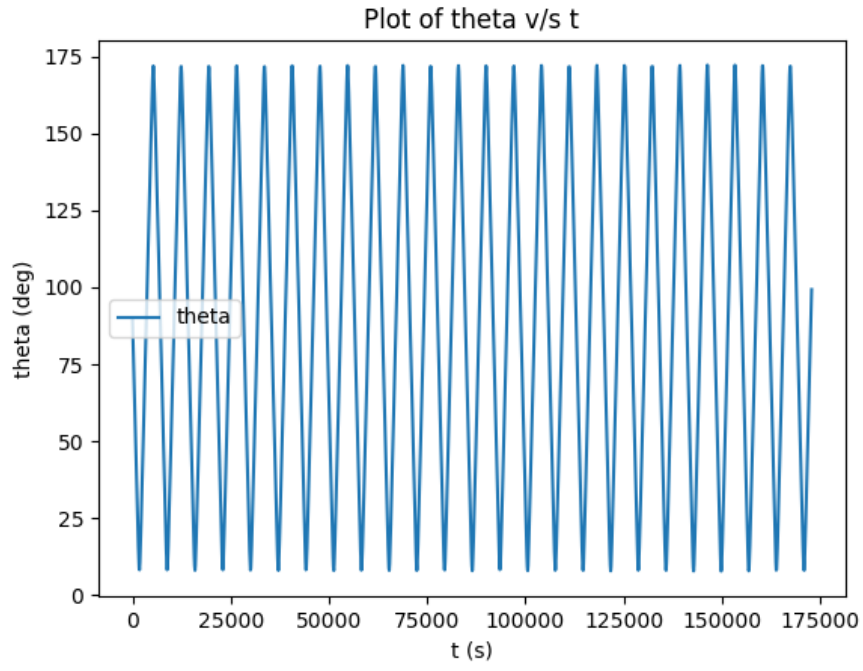
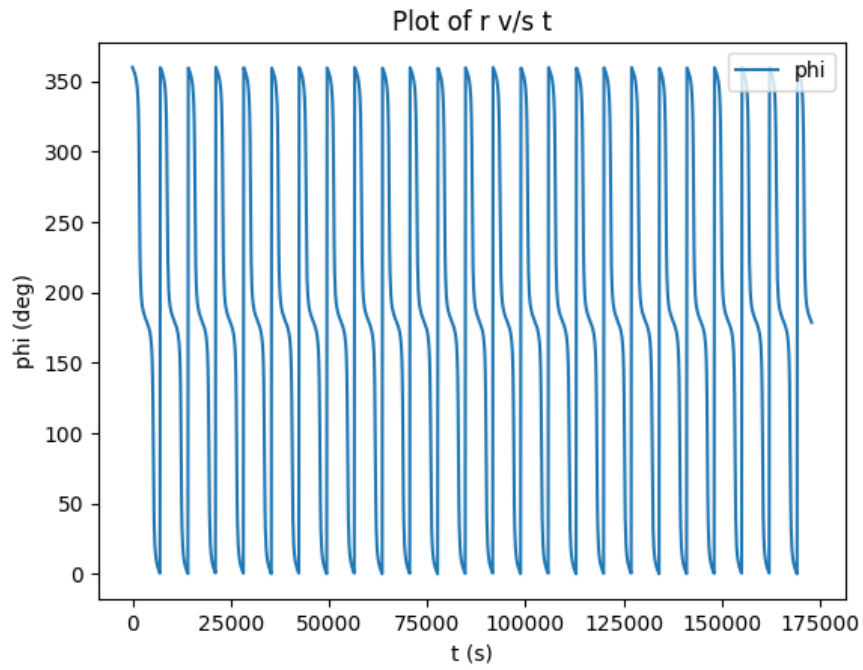Figure 5: Variation of co-latitude with time

Figure 6: Variation of phi with time

Intuition says that the orbit should precess with time. But no such thing observed. (wondering why)
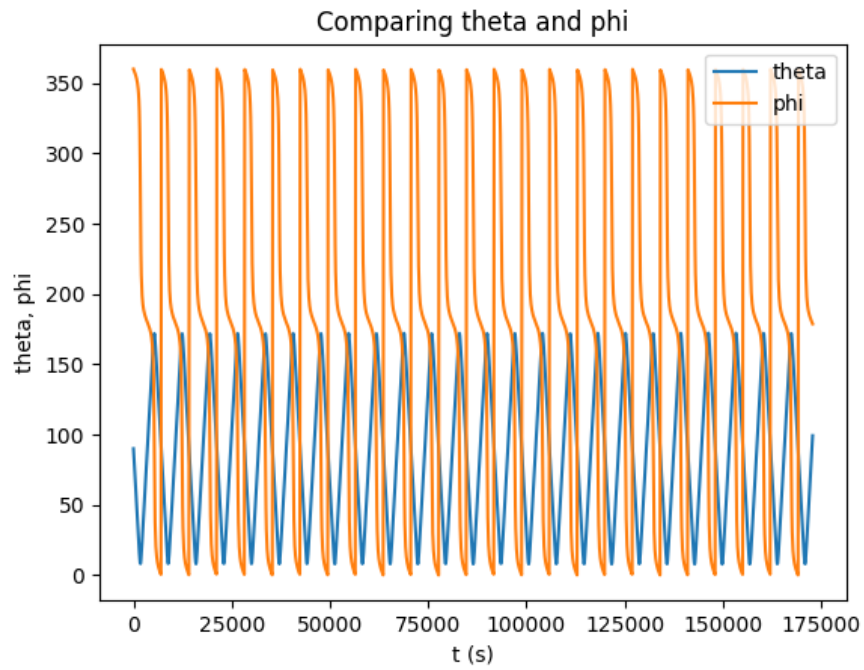
Figure 7: Variation of theta and phi

4 Things to do next:

- Include perturbations due to earth being an ellipsoid

- Better model of current in Tether - Tanya and Anuj required

- Debugging for r0 and thetherv

- Keep wondering why no precession is observed or is it observed