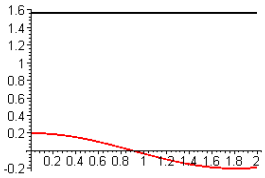
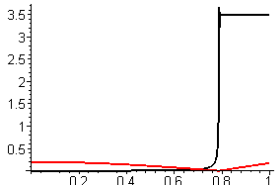
Maple numerical solution of the dumbbell satellite PhL 1.9.17

When I start at φ = π/2, I get the left below





where φ remains at π/2, and θ has both positive and negative values. But when I start at φ = 0 I get the right above where it does not pass through θ = 0 by instead forces φ to jump by π. Is there some way in Maple to restrict the desired range of φ and/or θ?

Here is a guy who thinks he is doing the spherical pendulum, I should see if he agrees with me

I want to plot the position of Spherical pendulum. there are differential equation for spherical pendulum in Spherical Coordinates.

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sys := {((D@@2)(phi))(t) = -2*(D(phi))(t)*(D(theta))(t)*cos(theta(t))/sin(phi(t)),
((D@@2)(theta))(t) = (D(phi))(t)^2*cos(theta(t))*sin(theta(t))-9.8*sin(theta(t))}
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$$\theta''(t) = \sin(\theta(t))\cos(\theta(t))\phi'(t)^2 - 9.8\sin(\theta(t))$$

$$\phi''(t) = \frac{-2\phi'(t)\theta'(t)\cos(\theta(t))}{\sin(\theta(t))}$$

with initial conditions

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theta(0) = (1/2)*Pi, (D(theta))(0) = 0, phi(0) = (1/2)*Pi, (D(phi))(0) = 1
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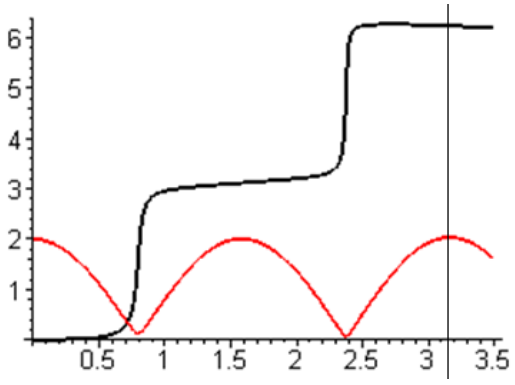
Notice that he has that same cot(θ) issue that I do, but he does not bring it up.

This starts with φ = 0 and so is out-of-plane oscillation



With $\omega = 1$ we have $T = 6.28$ sec.

We know from (F.5.13) that

$T_{outofplane} = T_{ocs2} = T/2 = 6.28/2 = 3.14$ verified in the figure

On the other hand we know from (F.5.10) that

$T_{omplane} = T_{ocs1} = T/\sqrt{3} = 6.28/1.73 = 3.63$ verified in the figure

