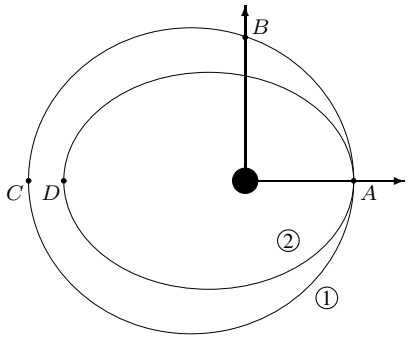
MAE3145: Simulating a Phasing Maneuver via STK

Due date: December 3, 2014

Problem 1 We discussed the following phasing maneuver in class. Consider an initial elliptic orbit ①with the periapsis A and the apoapsis C. There are chaser A and target B on the orbit. The initial true anomalies of the chaser and the target are given by $\theta_A = 0$ and $\theta_B = 90^\circ$, respectively. We designed a phasing orbit ②of the chaser such that the chaser catches the target at the point A.



$$r_A = 6800\,\mathrm{km}, \quad r_C = 13600\,\mathrm{km}, \quad \theta_A = 0, \quad \theta_B = 90^\circ.$$

We wish to simulate the resulting maneuver in STK according to the following steps.

1. Create a new scenario.
2. Insert the chaser satellite to the point A of Orbit ①.
$$a_1 = \frac{1}{2}(r_A + r_C), \quad e_1 = \frac{r_C - r_A}{r_C + r_A}, \quad i_1 = 0, \quad \omega_1 = 0, \quad \Omega_1 = 0, \quad \theta_A = 0.$$
3. Insert the target satellite to the point B of Orbit ①.
$$a_1 = \frac{1}{2}(r_A + r_C), \quad e_1 = \frac{r_C - r_A}{r_C + r_A}, \quad i_1 = 0, \quad \omega_1 = 0, \quad \Omega_1 = 0, \quad \theta_B = 90^\circ.$$
4. Take a snap shot of the resulting orbit at the 3D graphics window, and save it as a jpg file.
5. Double-click the chaser satellite at the left object browser, and change "Propagator" to "Astrogator" at the pull down menu.
6. Describe the phasing maneuver of the chaser as follows:
   - First impulse $\Delta v_A = -0.2485\,\mathrm{km/s}$ to transfer the chaser to Orbit ②
   - Propagate until periapsis of Orbit ②
   - Second impulse $\Delta v_A = +0.2485\,\mathrm{km/s}$ to transfer the chaser to Orbit ①
   - Propagate until periapsis of Orbit ①
7. Simulate the resulting maneuver at the 3D graphics window, and make it sure that the chaser catches the target.
8. Take a snap shot of the resulting orbit at the 3D graphics window, and save it as a jpg file.
9. Upload two jpg files from Step 4 and 8 to Blackboard.