ENAE 404 - 0101

Homework 03: Ground Tracks

Due on March 13, 2025 at 09:30 AM

Dr. Barbee, 09:30

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March 11, 2025

Problem 1:

Conceptual questions:

1. Give the semi-major axis, eccentricity and inclination of an orbit whose ground track is a point.
2. Explain why argment of periapsis equal to 0° or 180° produces equatorial symmetry.
3. Consider the Molniya orbit. Which one orbital element would you change so that the spacecraft would spend a long time veiewing the Southern hemisphere (rather than the Northern hemisphere)? Identify the orbital element and the value of this orbital element that would preserve the same structure of the ground track (just flipped to observe the Southern hemisphere).

Solution

Problem 2:

Plot one day ground tracks for the following orbits:

Spacecraft ID	a(km)	e	i(°)	Ω(°)	ω(°)
A	42164	0.3	40	0	0
B	26562	0.3	40	0	0
C	42164	0.3	60	0	70
D	42164	0.3	30	0	70
E	42164	0.3	120	0	0

Compare and contrast the ground track for Orbit E to that of Orbit A.

Solution

Problem 3:

Calculate the ΔV required to execute a Hohmann transfer from a circular orbit with radius 14×10^3 km to a circular orbit with radius 8×10^3 km. Assume the central body is the Earth. State whether the maneuvers increase or decrease the spacecraft's velocity.

Solution