ECE 6390 Homework: Look Angles and Perturbations

1. **Effects of Solar Pressure on Orbits:** A satellite is placed in GEO with a satellite subpoint aligned with Atlanta's longitude. The look angle for this satellite for an Atlanta-based earth station was derived in class.

   Now modify your numerical simulator to account for the effects of *solar pressure* on this GEO satellite. The result will now depend on the *area density*, ρ_A:

   $$\rho_A = \frac{m_s}{A_s}$$

   where A is the solar cross-sectional area of the spacecraft in square-meters and m_s is the mass of the spacecraft in kg. The force due to solar pressure near the earth (1.0 astronomical units) is given by

   $$F = 9.08\,\mu\text{N/m}^2 \times \alpha_r A_s$$

   where α_r is the effective reflectivity of the spacecraft. To solve for the following questions, you may make the following assumptions: 1) effective reflectivity for spacecrafts is 0.5, 2) assume solar pressure is always exerted in the equatorial plane, 3) assume solar pressure is arriving from a rotating direction in space to emulate the revolution of the earth about the sun.

   Over the course of 1 year, what is the minimum area density that a GEO satellite must have to drift 1-degree of azimuthal look angle in the sky without any correction? 5-degrees? 15-degrees?

   Design and graph 1-year of look angles for an orbit that minimizes azimuthal deviation for a spacecraft with 0.5 kg/m^2. Extra credit for the viable solution that results in the smallest 1-year deviation in the class.