

ME 594

Homework 1

Work the following problems, **SHOWING ALL OF YOUR WORK**. This includes writing the proper equation(s), inserting the proper value(s) into those equations, and calculating the final answer(s). If you utilize MATLAB or similar software, you may attach code and/or command line output to supplement your written work, but it is not meant to replace your written work. You may assume the Earth is a perfect sphere of radius 6378 km. Include the following statement at the top of your assignment:

“I ATTEST THAT I HAVE NEITHER GIVEN NOR RECEIVED HELP (other than from the instructor) ON THIS ASSIGNMENT.”

1. Consider a ground sensor at 35°N latitude & 108°W longitude. Let us define the sensor's “field of regard” as the entire area that the sensor can “see” above the horizon from its location on the Earth. This can be visualized by drawing a plane tangent to the Earth at the point where the sensor is located (see illustration below). Now consider an object in Earth orbit. At a particular instant in time, we know that the object's position vector from Earth's center expressed in ECI coordinates is (5294.35, 3707.14, 2352.42) km & that θ_g (Greenwich sidereal time) is 5° . Is the object within the sensor's field of regard at this instant?
2. Given the same sensor above at the same instant in time, consider a star at $\text{RA} = 17^\circ$, $\text{Dec} = 62^\circ$. Can the sensor “see” the star at this instant?

