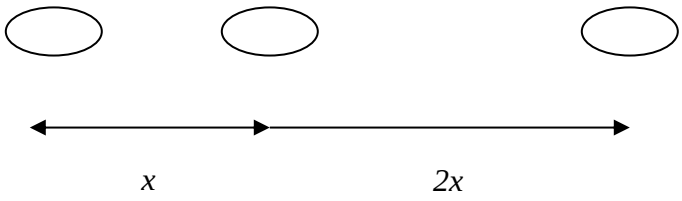
EE/Ae 157 a
Homework #4
Due Date: December 4, 2019

Problem 1. (10 points)

Plot the real part of the complex visibility function of the antenna configuration shown below. Assume that the individual antenna patterns are

$$A(\theta) = \cos\theta \quad -\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$$

Assume that $x = \lambda/2$. Hint: There are really three baselines synthesized by this configuration.



Problem 2. (20 points)

An imaging radiometer uses a conical scanning approach to achieve a swath width of 1400 km from a 600 km altitude. The antenna is 2m in diameter and the instrument operates at 10 GHz. The system has a bandwidth of 100 MHz, and a system noise temperature of $T_{rec} = 700\,\mathrm{K}$. The gain fluctuations are controlled to $\Delta G_s / G_s = 10^{-3}$ Calculate:

(a) The surface resolution and antenna pointing angle (ignore the curvature of the earth)
(b) The scanning rate in revolutions per minute assuming that the satellite moves at 7 km/sec
(c) The maximum dwell time for each pixel
(d) The sensitivity of the radiometer operated as a total power radiometer
(e) The sensitivity of the radiometer operated as an unbalanced Dicke radiometer if $T_a - T_{ref} = 10\ K$
(f) The sensitivity of the radiometer operated as a balanced Dicke radiometer

Assume we want to measure soil moisture, so use the antenna temperature as 300 K. In parts (e) – (f), assume that the integration time is equal to half the time it takes for the antenna footprint to move the distance equal to a footprint size.