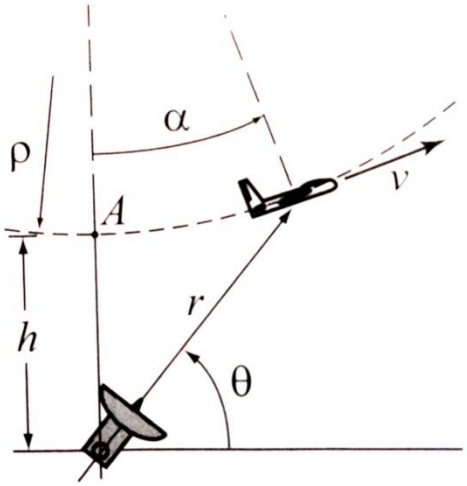
Week 10 Application Activity
ME219 Computer Programming for Engineers

This week's exercise is based on problem 4.17 in your MATLAB book[1]. The airplane shown is flying in a circular path with radius ρ, the bottom of which is located at a height h above the ground, with constant tangential velocity v. The airplane's position is being tracked by a radar station on the ground. In this exercise, you will be calculating the airplane's radial distance r and elevation θ relative to the radar station.



1. Start MATLAB, navigate to the directory where you want to save your work, and start a new m-file called "W10.m". Your program should do the following:
2. **PART 1**: using the 'input' command, prompt the user for v, ρ, and h. (When testing your code, try using the values $v = 50\ m/s$, $\rho = 2000m$, and $h = 500m$ as shown in your book).
3. **PART 2**: using the 'linspace' command, create a 100-element time vector going from zero to the time at which ∝ = 90°. To calculate the upper time limit, calculate the circumferential distance traveled between ∝ = 0° and ∝ = 90°, then divide by tangential velocity to get time.
4. **PART 3**: create a vector for α as a function of time, using the following relationship:

$$\alpha(t) = \frac{v}{\rho}t$$

5. **PART 4**: create vectors that represent the horizontal and vertical (x, y) coordinates of the airplane relative to the radar station, using the following equations:

$$x(\alpha) = \rho \sin \alpha$$

$$y(\alpha) = \rho(1 - \cos \alpha) + h$$

6. **PART 5**: convert your rectangular (x, y) coordinates into polar (r, θ) coordinates.
7. **PART 6**: using the 'min' command, determine the minimum value of θ, and the position in the θ vector where the minimum occurs. Use the latter as an array index to find the values of t and r where θ is minimized.
8. **PART 7**: using the 'fprintf' command, display a message in the command window that includes the minimal value of θ, as well as the t and r values where the minimum occurs.
9. **PART 8**: combine your t, r, and θ vectors into a single 3x100 matrix variable called voutput. Then, write this matrix to an output file using the following steps:
    a. Use the 'fopen'command to create a new file called 'output.doc'.
    b. Use the 'fprintf' command to write the column headers 'TIME', 'DISTANCE', and 'ANGLE' to your output.doc file
    c. Use the 'fprintf' command to write your voutput matrix to the output.doc file
    d. Use the 'fclose' command to close your output file.

When finished, upload **BOTH** files (W10.m AND output.doc) to Blackboard using the link provided.

REFERENCE

1. Gilat A., *MATLAB: An Introduction with Applications*, 4th ed., Wiley, Hoboken, NJ, 2011.