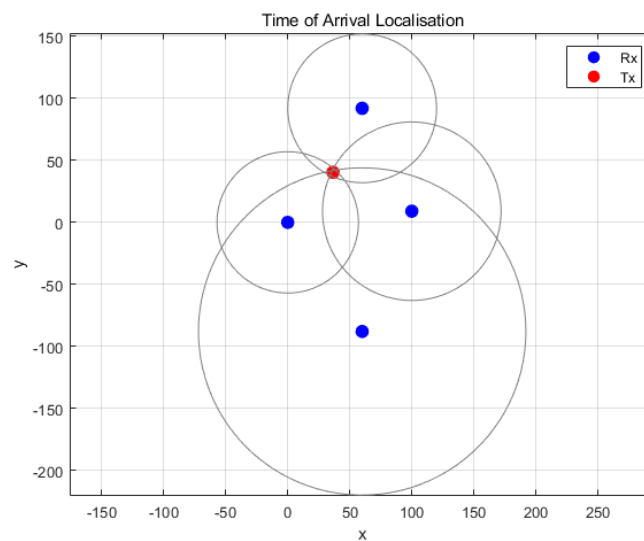


Advanced Communication Theory Coursework

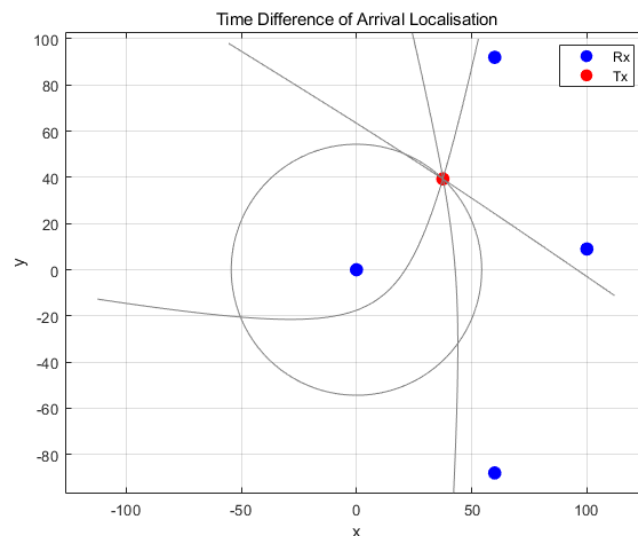
Part B

Task 1

First, estimate the arrival time of signals at 4 receivers, I designed an algorithm to realise it named “toa”. Then, use these TOAs and t_0 to calculate the distance and find the location of transmitter. The transmitter locates at the intersection of four circles in the following graph, the location is (36.493,40.421).

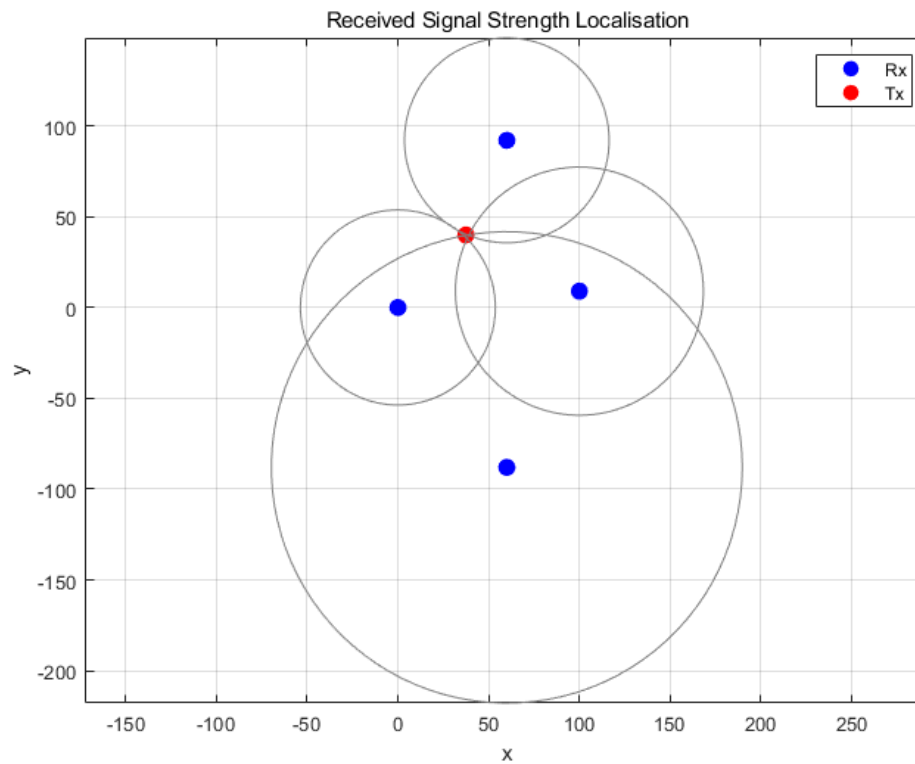


In the second part of task 1, we do not know t_0 , hence regard receiver 1 as the reference point, and calculate the distance between the other receivers and receiver 1. Then, use these distances to solve an equation to find the distance between receiver 1 and the transmitter hence the location of transmitter. The transmitter locates at the intersection of the circle and hyperbolas in the following graph, the location is (37.5115,39.3479)



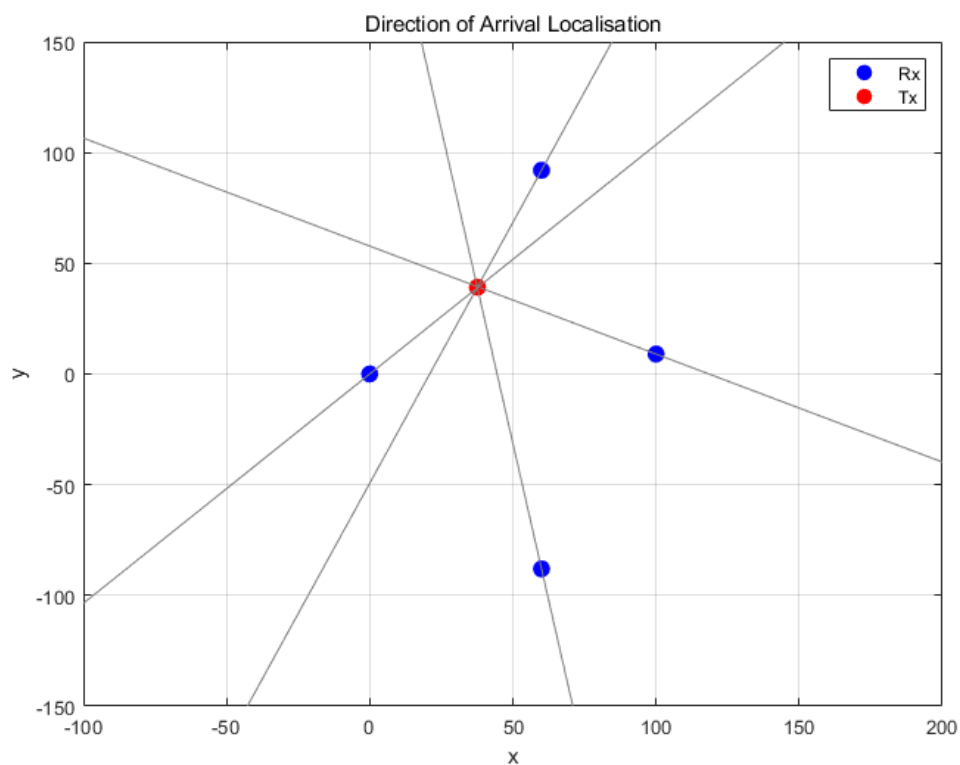
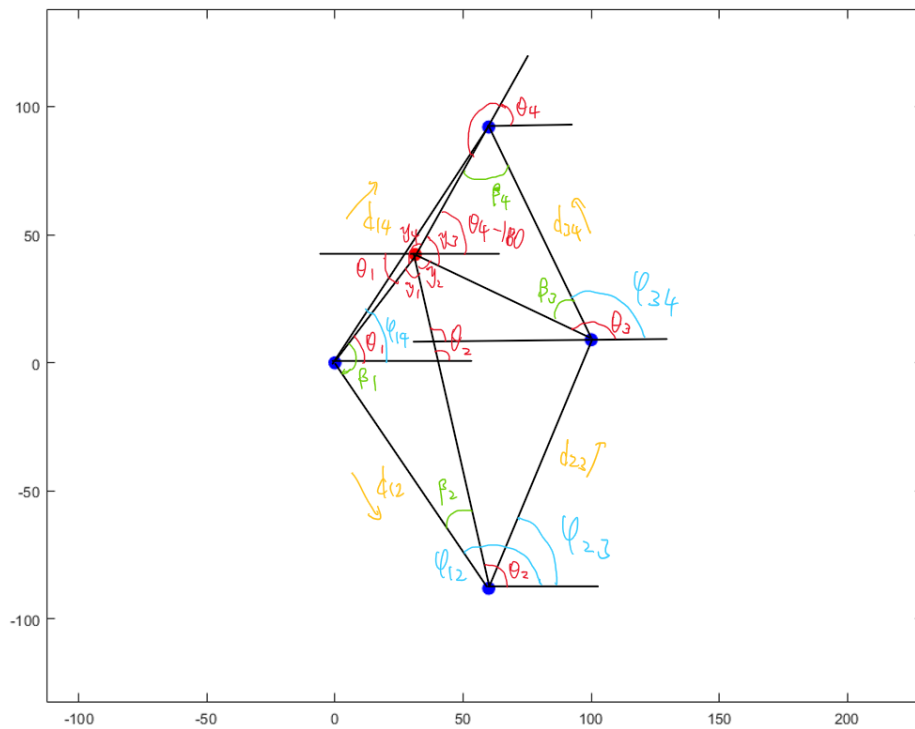
Task 2

In task 2, by calculating the power of received signal and with the help of Friis transmission equation, the distances between transmitter and each receiver are found. From the following figure, the transmitter locates at the intersection of four circles, which is more accurate than TOA in task 1, the location is (37.4563,39.934).



Task 3

In task 3, the direction of arrival is first estimated based on the MUSIC algorithm. Then, the distances between transmitter and each receiver are found based on the geometry. The first figure below shows how find the relationship between angles. The transmitter locates at the intersection of lines in the second figure below, the location is (37.6437,39.1754).



Task 4

In task 4, the four receivers are jointly considered as a large aperture array. The location of the transmitter is found based on finding the three reference points and draw three circles, the intersection is the location of the transmitter, which is (37.6437,39.1754).

