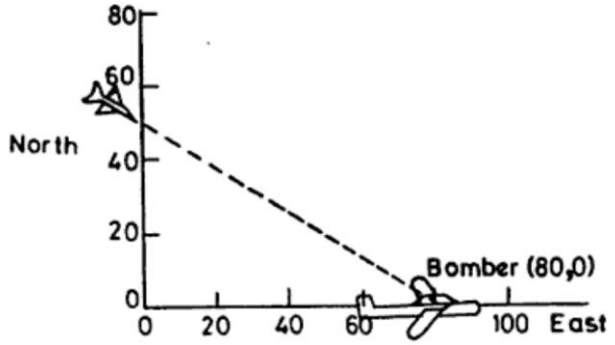
Programming Assignment-I

- Write a program in any of the language(C / C++ / Java / JavaScript/ Python / R / SciLab / Matlab), to simulate the pure pursuit problem explained in the following pages.
- Find out whether the fighter aircraft will be able to reach with in the firing distance from bomber.

- Upload the program screenshot and the output screenshots on github and submit the github link as assignment.
- Try to run the same program by changing the parameter including VF, XB/YB, initial positions of bomber/fighter. And share the data and results.

Simulation of pure pursuit problem(1/4)

- A fighter aircraft sights an enemy bomber and flies directly towards it, for destroying it.
- The bomber keeps on flying. It has got option of flying hapahazard/curved or in a line(let us assume straight line).
- Further lets assume, both the planes are flying in a straight lines in the 2-D plane.
- The fighter speed vf is 20km/min
- The target path (a function of time) is specified
- After a fixed time Δt the bomber changes its direction.



Time, t	0	1	2	3	4	5	6	7	8	9	10	11	12
$XB(t)$	80	90	99	108	116	125	133	141	151	160	169	179	180
$YB(t)$	0	−2	−5	−9	−15	−18	−23	−29	−28	−25	−21	−20	−17

Simulation of pure pursuit problem(2/4)

- Lets assume distance in Kms and time in minutes
- The coordinates of bombers are represented using XB(t),YB(t) and fighter be XF(t), YF(t).
- Initial conditions
  - XF(0)=0, YF(50)=0
  - XB(0)=80, YB(0)=0
- Target is to compute the position of pursuer viz xf(t),yf(t), until the fighter is within 10kms of bomber.
- Once bomber is in the range of pursuer(10kms), the fighter can fire a missile.
- If it doesn't happens within 12 minutes, the pursuit is abandoned and the target(bomber is considered escaped).
-

Simulation of pure pursuit problem(3/4)

- Strategy

- The fighter looks at the target(bomber) at instant t, aligns its velocity vector with the line of sight(i.e.) points itself towards the target).
- It continues to fly in that director for one minute(t+1).
- At time (t+1), assess and realign itself.
- The distance DIST(t) at a given time t between the target and the pursuer is given by

$$\text{DIST}(t) = \sqrt{(YB(t) - YF(t))^2 + (XB(t) - XF(t))^2}$$

- The angle θ of the line from the fighter to the target at a given time (t) is given by

$$\text{Sin}\,\theta = \frac{YB(t) - YF(t)}{\text{DIST}(t)}$$

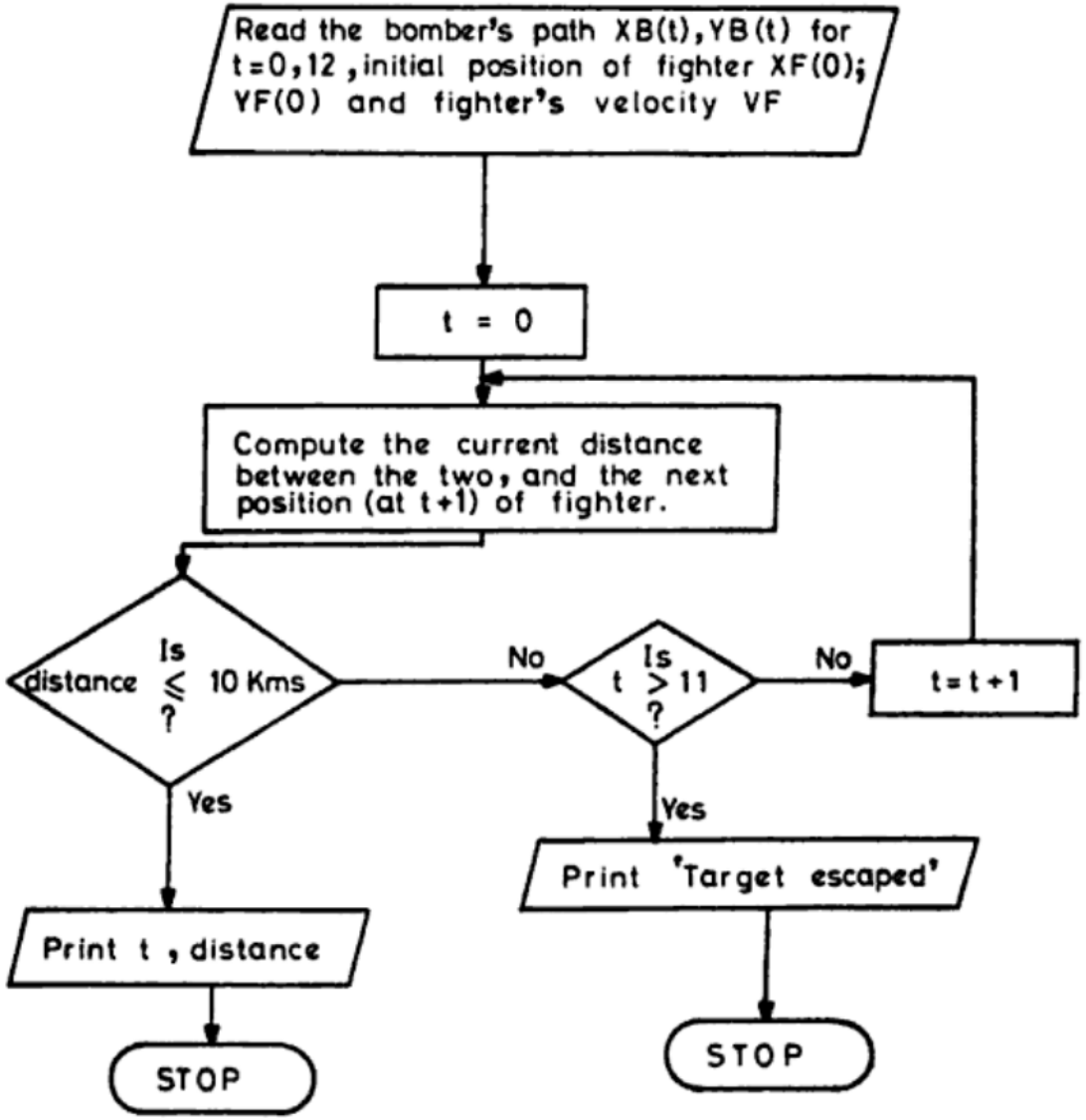
$$\text{Cos}\,\theta = \frac{XB(t) - XF(t)}{\text{DIST}(t)}$$

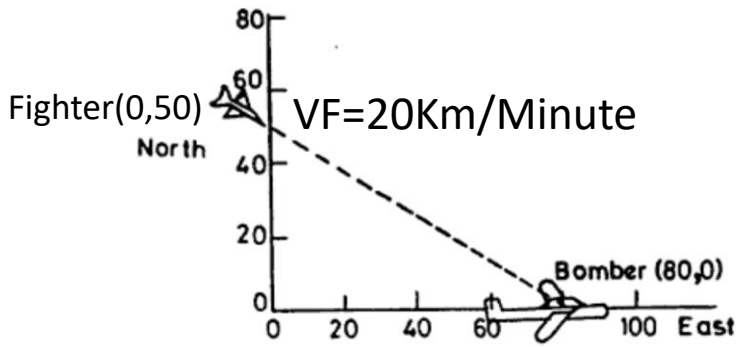
- Using above formulae the position at (t+1) for the fighter is given by

$$XF(t+1) = XF(t) + VF\,\text{Cos}\,\theta$$

$$YF(t+1) = YF(t) + VF\,\text{Sin}\,\theta$$

Simulation of pure pursuit problem(4/4)





Time, t	0	1	2	3	4	5	6	7	8	9	10	11	12
$XB(t)$	80	90	99	108	116	125	133	141	151	160	169	179	180
$YB(t)$	0	−2	−5	−9	−15	−18	−23	−29	−28	−25	−21	−20	−17

$$\text{DIST}(t) = \sqrt{(YB(t) - YF(t))^2 + (XB(t) - XF(t))^2}$$

$$\sin\theta = \frac{YB(t) - YF(t)}{\text{DIST}(t)}$$

$$\cos\theta = \frac{XB(t) - XF(t)}{\text{DIST}(t)}$$

$$XF(t+1) = XF(t) + VF\cos\theta$$

$$YF(t+1) = YF(t) + VF\sin\theta$$