

# Worst-Case Scenario Evasive Strategies in a Two-on-One Engagement between Dubins' Vehicles with Partial Information (Additional simulation results)

Suryadeep Nath and Debasish Ghose

The two-phase evasive strategy (*WCSP* + *PBM*) is deployed against two pursuers using proportional navigation with navigation gain  $N = 3$ . Fig. 1 shows four scenarios of pursuit-evasion engagement under varying parameter values.

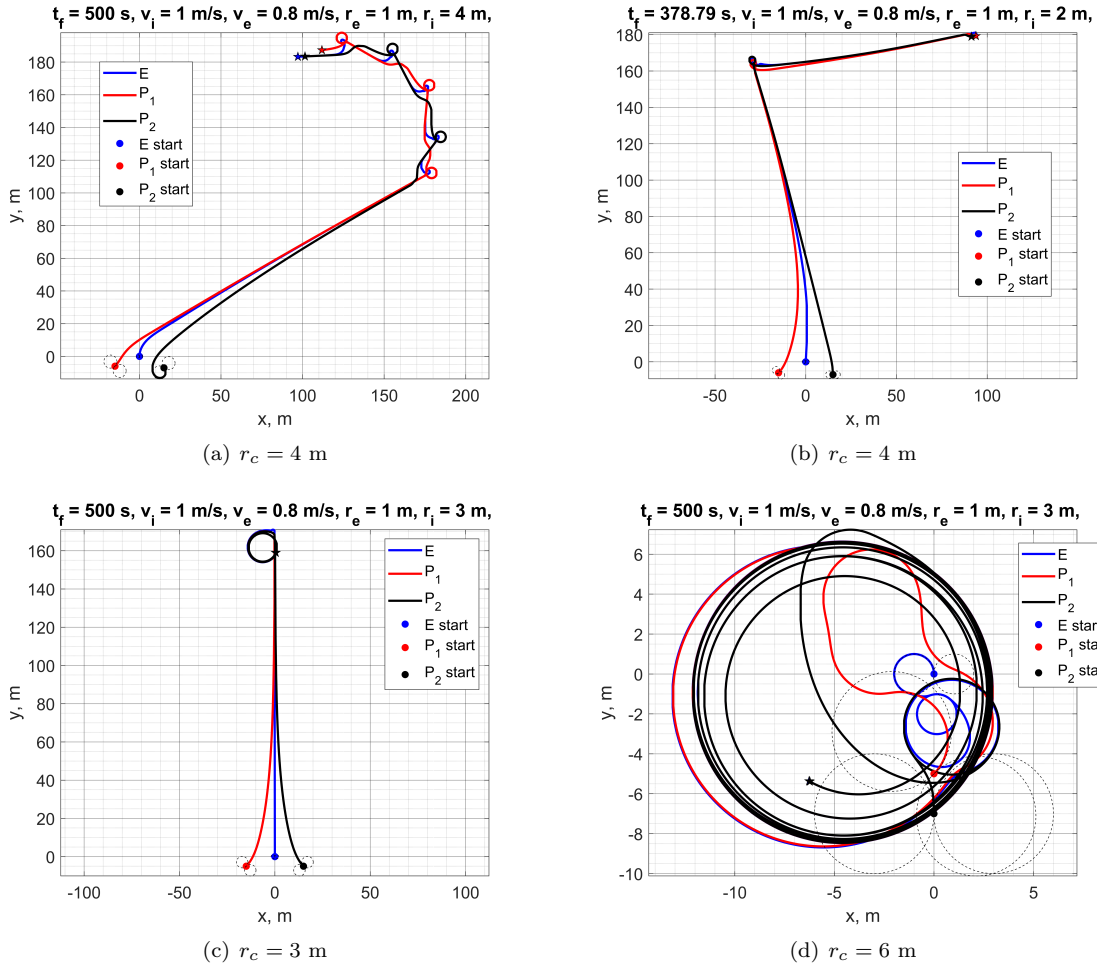


Figure 1: Two-phase evasive strategy against identical pursuers

In Fig. 1(a), the critical alert region radius is set to  $r_c = 3$  m, the evader's minimum turn radius  $r_e = 1$  m and the pursuers' turn radius  $r_i = 4$  m. The evader executes the *WCSP* phase initially which culminates in a tail chase followed by the *PBM* phase. Then a periodic pattern starts with the evasive strategy alternating

between the two phases. Though the evader prevents capture, it does not indefinitely increase separation from the pursuers. In Fig. 1(b), the pursuers are more agile and have smaller turn radii  $r_i = 2$  m. The evader is captured in this scenario as the *PBM* phase is not very effective in creating separation between the evader and the pursuers. In Fig. 1(c),  $r_c = 3$  m. A smaller  $r_c$  implies a late initiation of the *PBM* phase. In this case, the pursuers get too close to the evader before the latter starts taking high-curvature maneuvers. The pursuers get within a minimum turn circle of the evader and the evader starts moving along *CC* trajectories, as per the *PBM* phase strategy, alternating between left and right turns, resulting in net motion along a low-curvature path enabling the pursuers to capture it. In Fig. 1(d),  $r_c = 6$  m. A large  $r_c$  value implies early initiation of the *PBM* phase. The evader is unable to switch out from the *PBM* because of the large  $r_c$  value. The evader is also captured in this scenario for similar reasons as in Fig. 1(c). Also, owing to a large  $r_c$  value, the motion of the evader is restricted to a much smaller region compared to the other scenarios.

These are the trajectories of some randomly initiated engagement and the observations are made on varying some of the parameters. In a future work, we will study the motion patterns of both the evader and pursuers in greater detail, and the effect of each governing parameter on the trajectory along with possible analytical explanations for the same.