Dynamics of the homicidal chauffeur game

Car

$$P: \quad \begin{aligned} \dot{x}_p &= w \sin\theta \\ \dot{y}_p &= w \cos\theta \\ \dot{\theta} &= wu/R, \ |u| \leqslant 1 \end{aligned}$$

Pedestrian

$$E: \quad \begin{aligned} \dot{x}_e &= v_1 \\ \dot{y}_e &= v_2 \\ v &= (v_1, v_2)', \ |v| \leqslant \rho \end{aligned}$$

In normalized coordinates

$$P: \quad \begin{aligned} \dot{x}_p &= \sin\theta \\ \dot{y}_p &= \cos\theta \\ \dot{\theta} &= u, \qquad |u| \leqslant 1 \end{aligned}$$

$$E: \quad \begin{aligned} \dot{x}_e &= v_1 \\ \dot{y}_e &= v_2 \\ v &= (v_1, v_2)', \ |v| \leqslant \nu \end{aligned}$$