Assignment 2 Part 1

- Implement the bicycle model in Matlab, with skid-slip and with two distinct sampling intervals (Euler integration dt & controller DT).
- Input: control vector **u=[**$\gamma_d\ v_d$ **]**, state vector **q**, and all parameters (e.g., dt, DT, *L*, s, δ_1, δ_2), control and state constraints.
  - Note: input for turning could also be ω, or R.
- ***<u>Assume zero slip and skid</u>***
- Tractor wheel radius = 0.5m;
  Wheelbase = 2.5 m; $|\gamma_{max}| \leq 45^o$; $|v_{max}| \leq 5$ m/s
- Assume dt=DT=0.01 s.
- Apply input to turn at headland from one row to the next; row-center distance =2 m.
- Does it work? Why? Try row-center distance = 3 m. Show traces.

Assignment 2 Part 2

- ***<u>Non zero slip and skid</u>***
- Use same parameters as before.
- Add small slip angles δ1 and δ2 (e.g., 4^o)
- Apply input to turn at headland from one row to the next; row-center distance =3 m.
- What happens as slip angles δ1 and δ2 (skidding) increase? (Assume zero slip, s, for rear driven wheel).
- What if skidding is zero (δ1= δ2=0) and only slipping affects the rear wheel?

Assignment 2 Part 3

- Augment bicycle model with 1st order closed-loop steering and speed dynamics.
- Plot vehicle path for γ_d step function (0 to γ_{max}) and:
- 1. Speed lag:
  τ_v = 0 s; τ_γ from 0 to 2 s (same plot).
  - (How will you implement τ_v or $\tau_\gamma = 0$?)
- 2. Speed lag:
  τ_v = 1 s; τ_γ from 0 to 2 s (same plot).
- Comment on these plots.