Autonomous Driving and Complexity of Roundabouts

- Autonomous vehicles are well-prepared for lane keeping, acceleration and distance control, lane changing, and even cross sections.
- Current self-driving vehicles still struggle to handle roundabouts safely.
- In case of roundabouts, AI of autonomous cars usually tosses the control of the vehicle to the human driver in the last moment.

Longitudinal Control and Passenger Comfort

- System Identification
- Transfer Function Interpolation and State-Space Conversion
- A Tuned PI Controller in line with Maximum Allowable Acceleration and Jerk
- Prediction Horizon of 10 Seconds, Control Horizon of 2 Seconds
- Less than 3% Overshoot

Lateral Control for Waypoint Following

- Bicycle Model Estimation and Decoupled Dynamics for Low-Speed Regime
- The Proposed STANLEY Control Law by Stanford University in DARPA Grand Challenge
- Optimization of Control Gains for Minimizing of the Cross-Track Error

Artificial Intelligence and Machine Learning for Navigating Roundabouts

- The lateral and longitudinal control need to avoid conflicts in roundabouts.
- AI-based exit probability estimate the likelihood of such conflict
- Based on lateral and longitudinal speed of in-bound vehicles
- The proposed lateral and longitudinal control provides a higher granularity to train the AI-based exit probability model.

Conclusion

- Proposed an accurate lateral and longitudinal control mechanism for autonomous vehicles to safely drive through roundabouts.
- Roundabout conflict avoidance based on AI
- Provide higher precision in AI training for roundabout exit probability