Modelling, simulation, and control of assisting motor and control rules of Electric Powered Steering (EPS) system.

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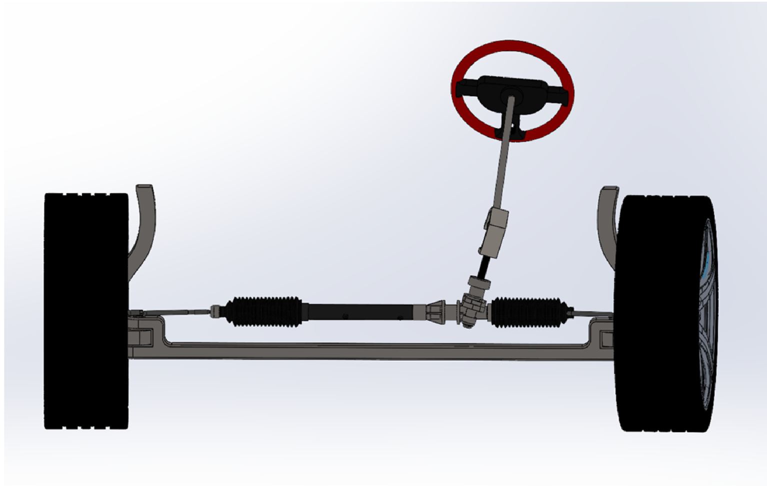

1 Abstract:

The EPS system is an essential component of modern automobiles that assists the driver in steering the vehicle. This capstone project aims to develop control rules that enhance the performance of the EPS system and make it more effective in assisting the driver. To achieve this goal, a model of the EPS system is developed and simulated using computer software. The simulation results are then used to design control rules that optimize the performance of the EPS system. The poster highlights the key findings of the project and demonstrates the effectiveness of the proposed control rules through simulation results. The project has significant implications for the automotive industry, as it can lead to the development of more efficient and reliable EPS systems that improve the driving experience and safety of vehicles.

2 Objectives, scope and mission summary:

- Objective: solve the simulation model of the control rules of Electric Power Steering system using MATLAB/Simulink/Simscape and integration with steering system and vehicle body dynamics model.
- Contents need to be done:
  - Summary theoretical basis of EPS system
  - Simulate the model and control of electric motor
  - Simulate the model and control rules of EPS system in Simulink and Simscape

3 THEORETICAL BASIS

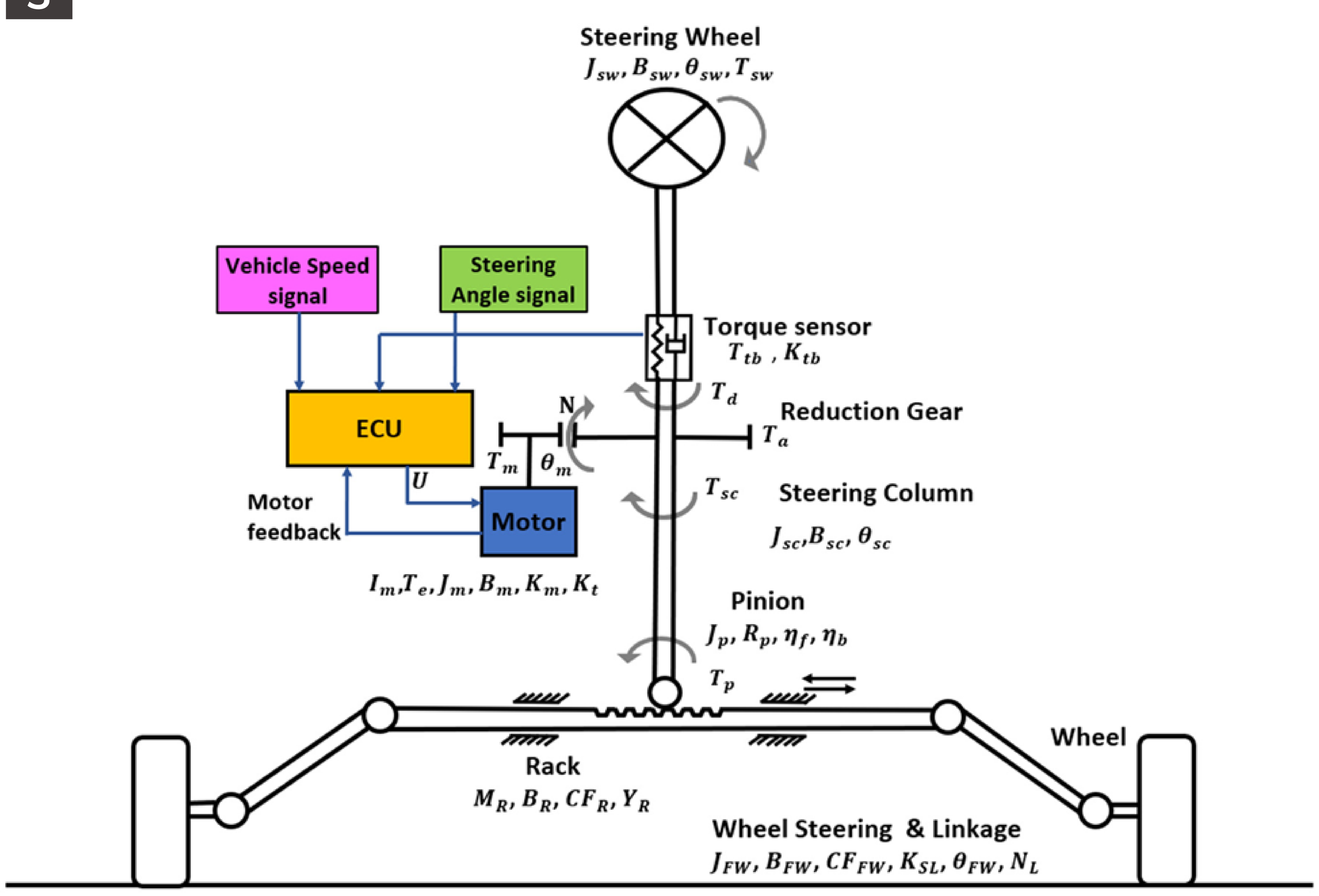

Figure EPS overall structure

Working principle: The EPS system works by using a torque sensor to detect the amount of effort applied to the steering wheel by the driver, and then sends an electric signal to the EPS motor to provide the necessary power assistance.

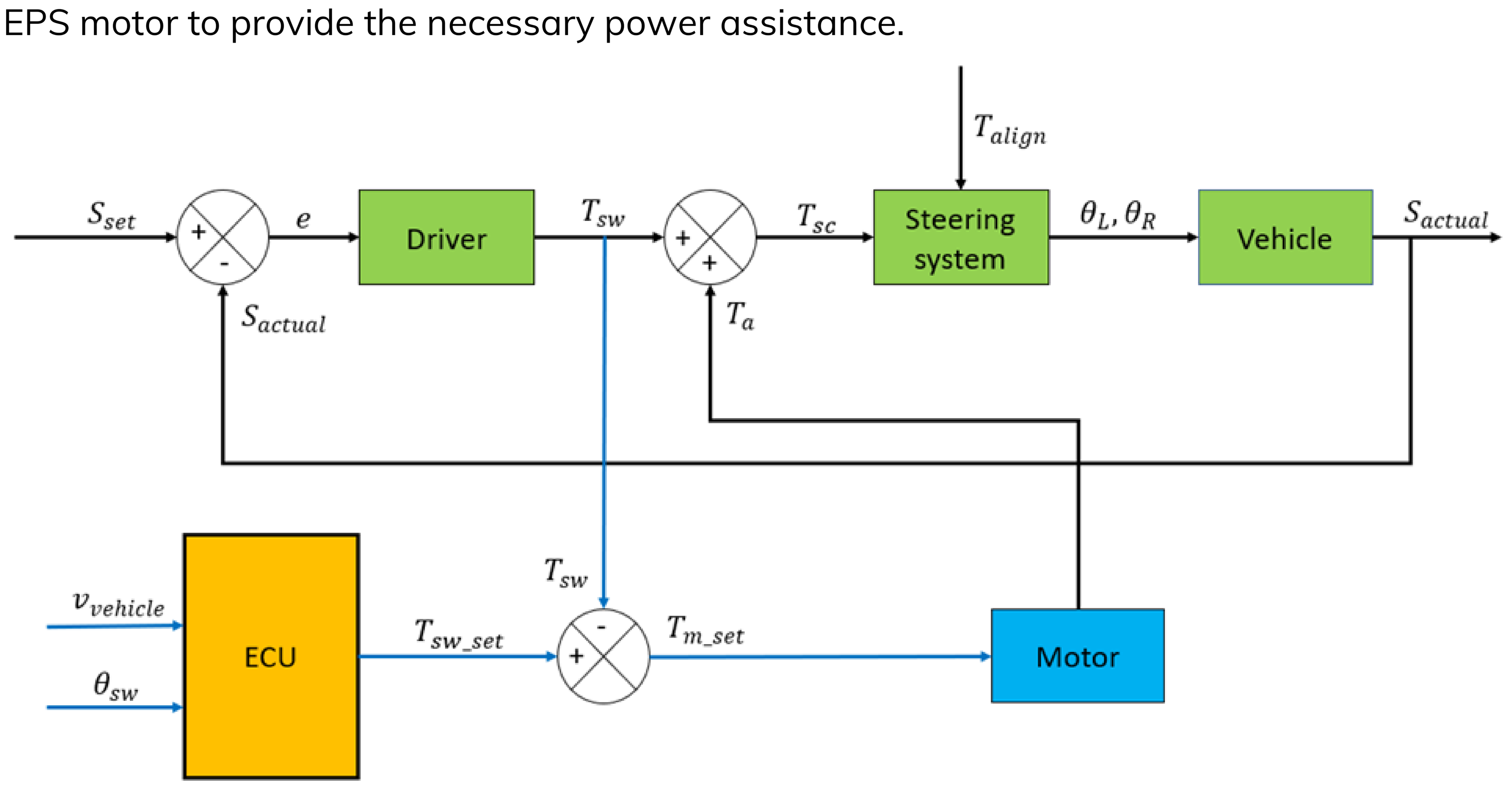

Figure EPS block diagram

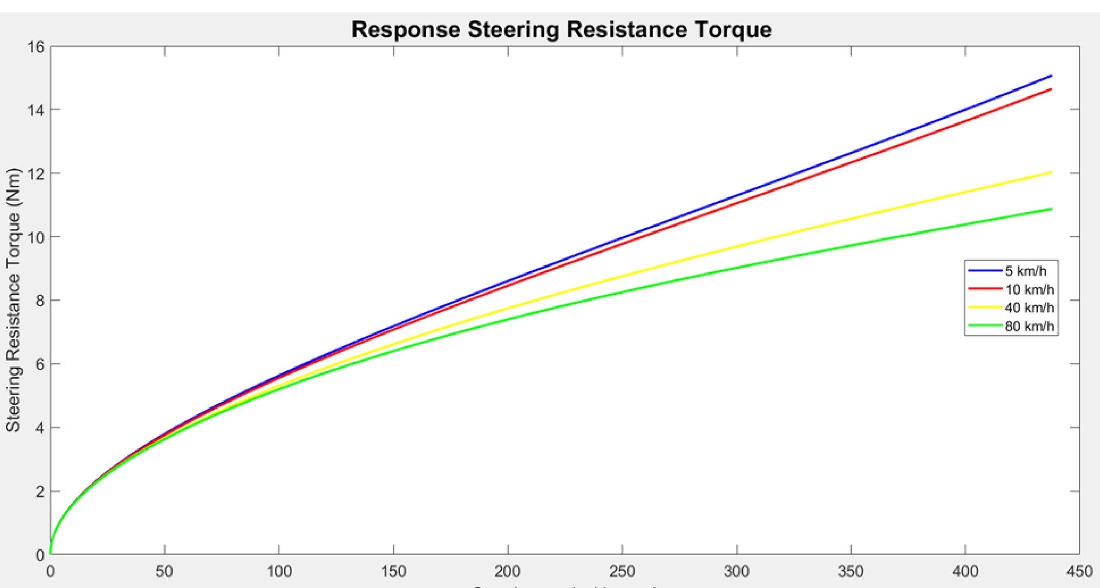

Figure EPS control rules

Control rules: If the input steering torque of the driver exceeds the limit, the motor will be turned on to provide the assistance torque, if not, the motor will not be turned on.

- Low steering angle => low resistance torque => less assistance => low limit
- High steering angle => high resistance torque => more assistance => high limit
- Low speed => high resistance torque => more assistance => low limit
- High speed => low resistance torque => less assistance => high limit

4 Matlab/Simulink modeling:

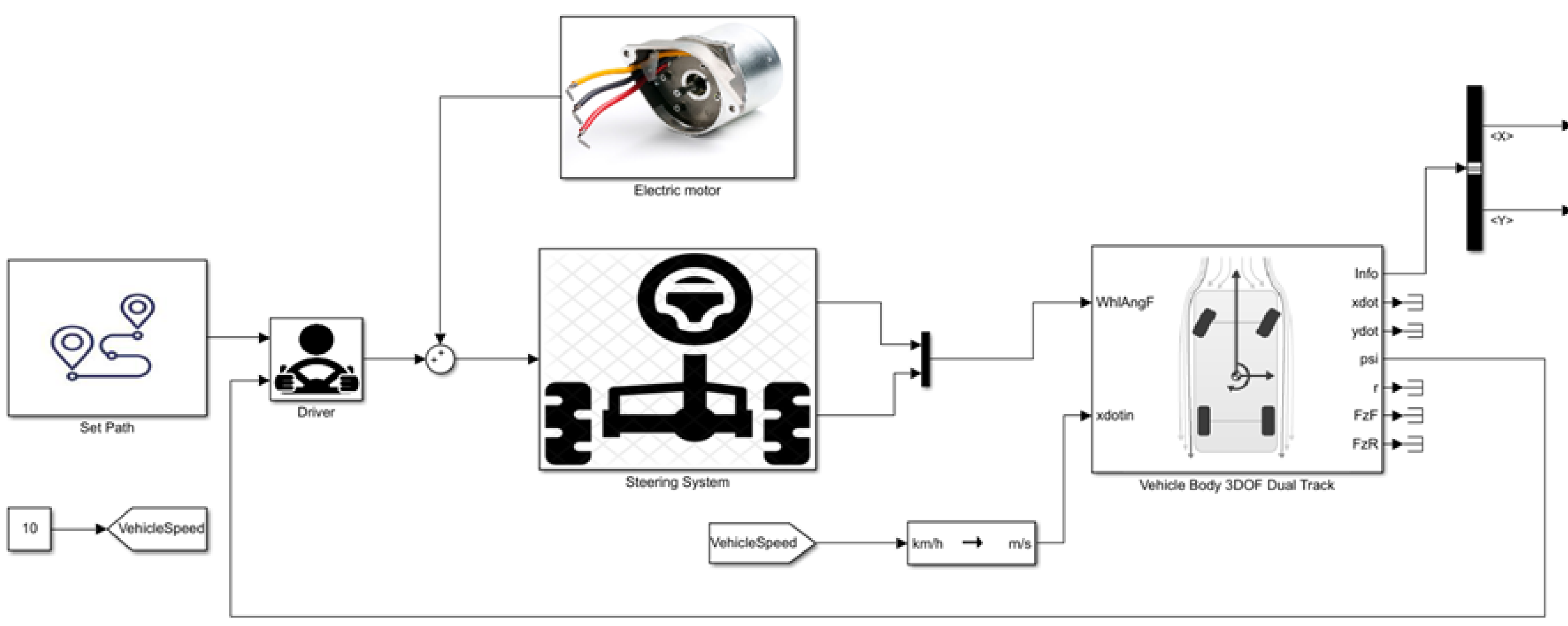

Figure EPS complete model in MATLAB/Simulink

7 Specific results:

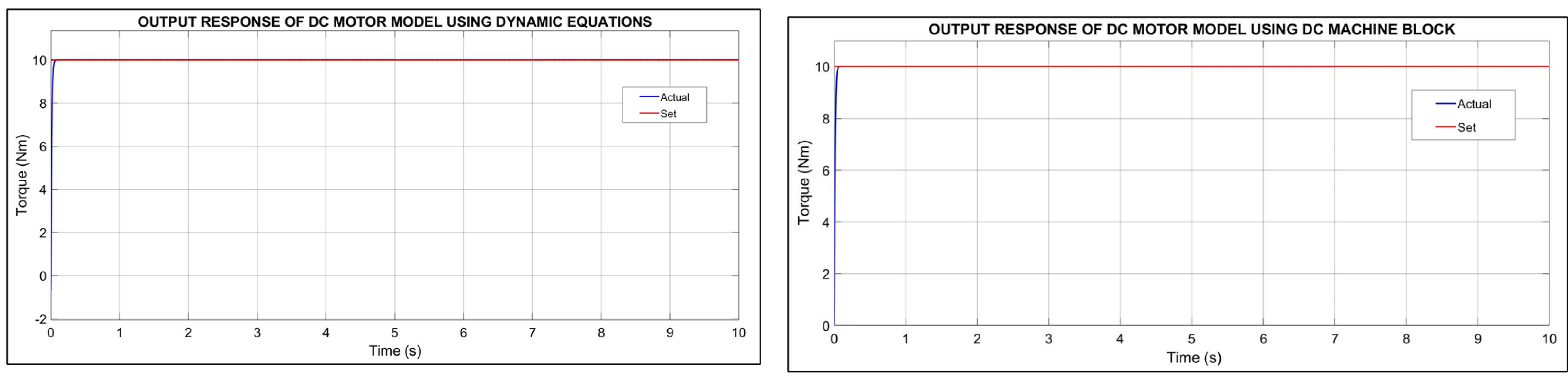

Figure Output response of DC Motor models

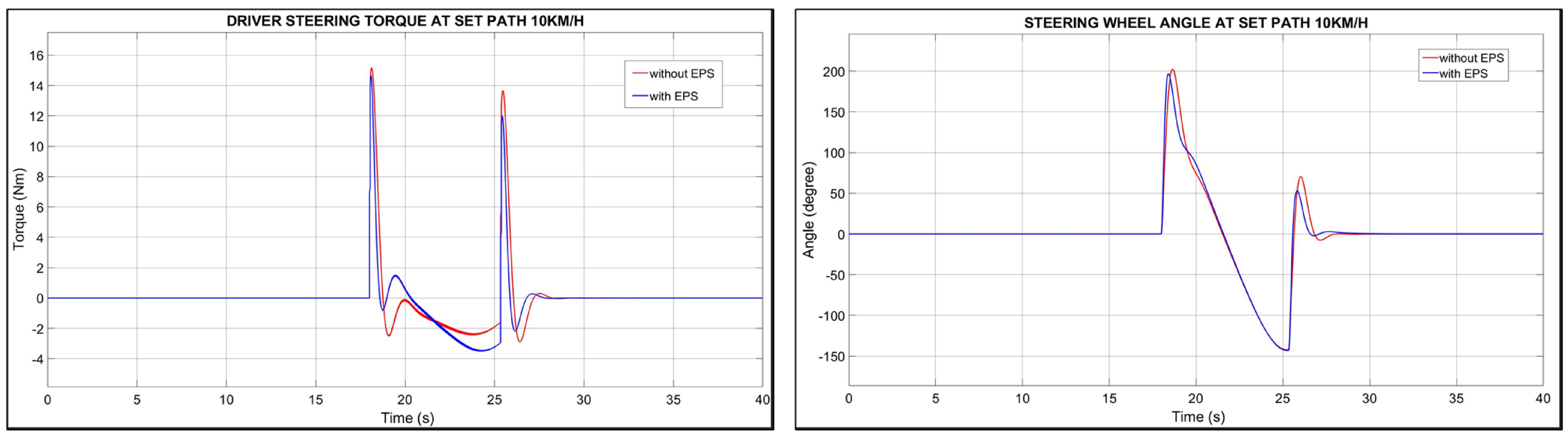

Figure Driver responses at set path 10km/h

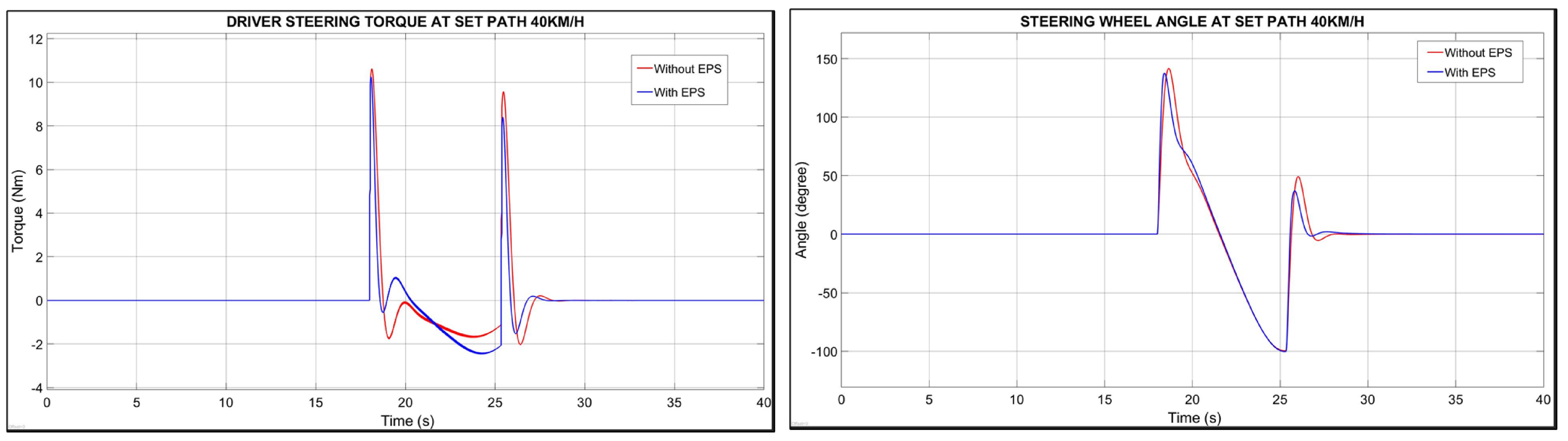

Figure Driver responses at set path 40k/h

8 Conclusion and future plan:

- Conclusion
  - The simulation and modeling of this project's control rules for EPS systems have also shown that the assistance provided to the driver is inversely proportional to the vehicle's speed. That is, the lower the speed, the higher the assistance, and vice versa.
  - The simulation results confirm the behavior of real-world EPS systems, indicating that the model accurately replicates the control algorithm used in EPS systems.
- Future work
  - Enhance the accuracy and realism of the simulation model by incorporating data from real-world driving scenarios and testing conditions.
  - Improve the predictive capabilities of the model, allowing for more accurate and reliable simulations of different driving scenarios.
  - Develop new control rules and algorithms for EPS systems could help to further optimize the performance and efficiency of these systems

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