| **HCMC UNIVERSITY OF TECHNOLOGY**  Faculty of Transportation Engineering  ----------o0o---------- | **SOCIALIST REPUBLIC OF VIETNAM**  Independence – Freedom – Happiness  ----------o0o--------- |
| --- | --- |

MIDTERM REPORT OF THESIS/CAPSTONE PROJECT

SEMESTER \_\_\_\_\_\_

**1. Thesis title:** Modeling and simulation using Matlab/Simulink and its applications in The Electric Power Steering system in VIOS.

**2. Advisor’s fullname:** PhD. Ngô Đắc Việt

PhD. Trần Đăng Long

**3. Student’s fullname:** Hồ Bình Minh **- ID:** 1852169

Trịnh Tiến Long **- ID:** 1852047

Đặng Minh Duy **- ID:** 1910933

Nguyễn Nhật Duy **- ID: 1910088**

**4. Thesis content:**

**4.1. Type:** ◻ A product design ◻ A technical evaluation

◻ A scientific research ◻ Other:

**4.2. Objectives & Technical requirements:**

\_ How wheel alignment can affect the resistance torque in the steering mechanism especially in the EPS system.

\_ Required to get fully understanding knowledge about the resistance torque between the tire force and road surface in steering mechanism especially in the EPS system.

\_ Contribution to an analysis of the dynamic behavior of the mechanical components of EPS

system

\_ Analysis of the complete system dynamics of EPS, and implementation of the EPS simulation

model on Matlab/Simulink, with simulation results analysis using Simscape Multibody.

- Simulation the rules of control of assisting DC motor of EPS according to different vehicle speeds and steering wheel’s angles

**4.3. Core problems to be solved & Solving ideas/methods:**

\_ Research and calculate the equation of the resistance torque between tire and road for longitudinal force, lateral force and normal force.

\_Build EPS model on Simscape to determine the torque acting on steering wheel with certain steering angle

– Calculate and determine assisting moment of the motor in different vehicle speeds and steering angles

**4.4. Works to be done & Required results:**

| **No.** | **Works to be done** | **Required results** *(Ex: data, equations, models, diagrams, parameters, charts, findings…)* |
| --- | --- | --- |
| 1 | Dynamic formula for EPS system | Equation |
| 2 | Solidwork model for simscape simulation | Model |
| 3 | The resistance torque model for the tire and road in the Electric Power Steering system. | Equation |
| 4 | Research on theory of automatic control system | Finding |
| 5 | Simulation of motor model in MATLAB/Simulink | Model |
| 6 | Calculate and determine control rules of assisting motor | Data, Parameter, Finding |
| 7 | Simulation of control rule combing with mechanical model of steering system | Model, Charts |

**4.5. Requested products:**

x Technical report x Poster ◻ Scientific paper

◻ Software ◻ Firmware x Numerical model

◻ General layout drawings ◻ Detailed drawing x Assembly drawings

◻ Others:

**4.6. Scope of Thesis:**

\_This capstone project focuses on the control rules of assisting motor and EPS system, does not focus on analysis of electrical components of the system

\_Components that are not related to the EPS system are ignored.

\_ The resistance torque between tire and road for wheel alignment in the case of longitudinal force, lateral force and normal force.

**4.7. Tasks of each team member:**

| **No.** | **Member’s full name** | **Works assigned** |
| --- | --- | --- |
| 1 | Trịnh Tiến Long | Summary the dynamic equation, simulate using simscape multibody |
| 2 | Hồ Bình Minh | Summary the resistance torque theory between tire and road and model them into MATLAB |
| 3 | Đặng Minh Duy | Simulation of control of assisting motor and control rules of EPS according to the operating conditions of vehicle speed and steering wheel’s angles |
| 4 | Nguyễn Nhật Duy | Simulation of control of assisting motor and control rules of EPS according to the operating conditions of vehicle speed and steering wheel’s angles |

**5. Achievements by midterm:**

| **No.** | **Works done** | **Required results** | **Actual results** | **Degree of completion**  (0-100%) |
| --- | --- | --- | --- | --- |
| 1 | Dynamic equation for EPS | Equation | Equation | 100% |
| 2 | Solidwork model | Full model | Part of model | 50% |
| 3 | The resistance torque model between tire and road | Full model | Full model | 100% |
| 4 | **Study on theory of automatic control system** | Full model | Full model | 100% |
| 5 | **Build assisting motor model and control of motor’s moment in MATLAB** | Full model | Full model | 70% |
| 6 | **Calculate and determine control rule of EPS system** | Full model | Full model | 70% |
| 7 | **Build simulation model of control rules of EPS in MATLAB** | Full model | Full model | 50% |

**6. Current technical errors (if any) & Proposed solutions:**

| **No.** | **Works done** | **Current errors** | **Causes** | **Solutions to overcome** |
| --- | --- | --- | --- | --- |
| 1 | Solidwork model | Wrong kinematic movement | Wrong parameter for model | Re-draw with VIOS parameter |
| 2 | MATLAB model | Not accomplished model | Wrong connection blocks | Reconnect the blocks |
| 3 | **Control of motor’s moment in MATLAB** | The control has not been completed by the motor driver | Wrong control method the motor driver | Control analog voltage for the motor driver |

**7. Threats and causes lead to completion delay (if any) & Proposed solutions:**

| **No.** | **Works & Corresponding threats** | **Causes** | **Degree of risk of completion delay** *(Low/Medium/High)* | **Solutions to overcome** |
| --- | --- | --- | --- | --- |
| 1 |  |  |  |  |
| … |  |  |  |  |

**8. Updated working plan for 15+1 weeks:** *(including the degree of completion of each task, and additional works to finish the Thesis/Project on time (if any))*

| **No.** | **Works** | **Week** | | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **X** | **11** | **12** | **13** | **14** | **15** | **16** |
| 1 | **Introduction of project** | **x** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | **Synthetic theory** |  | **x** | **x** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | **Choose plan and prepare technical paper for reference** |  |  |  | **x** | **x** | **x** |  |  |  |  |  |  |  |  |  |  |
| 4 | **Build tire dynamic model** |  |  |  |  |  |  | **x** | **x** |  |  |  |  |  |  |  |  |
| 5 | **Draw solidwork model** |  |  |  |  |  |  |  | **x** | **x** |  | **x** | **x** |  |  |  |  |
| 6 | **Build EPS model** |  |  |  |  |  |  |  |  |  |  |  |  | **x** | **x** | **x** |  |
| 7 | **Study on theory of automatic control system** |  | **x** | **x** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | **Build assisting motor model and control of motor’s moment in MATLAB** |  |  |  | **x** | **x** | **x** | **x** |  |  |  |  |  |  |  |  |  |
| 9 | **Calculate and determine control rule of EPS system** |  |  |  |  |  |  |  | **x** | **x** |  | **x** |  |  |  |  |  |
| 10 | **Build simulation model of control rules of EPS in MATLAB** |  |  |  |  |  |  |  |  |  |  | **x** | **x** | **x** | **x** |  |  |
| 11 | Make poster |  |  |  |  |  |  |  |  |  |  |  | **x** |  |  |  | **x** |
| 12 | Make presentation slides |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **x** |
| 13 | Write full report |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **x** |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Student:** Hồ Bình Minh **-ID:** 1852169 -**Signature:** Minh

**Student:**Trịnh Tiến Long **-ID:**1852047 - **Signature:**Long

**Student:** Đặng Minh Duy **-ID:** 1910933 - **Signature:** Duy

**Student: Nguyễn Nhật Duy** **-ID:** 1910088 - **Signature:** Duy

**Date** (dd/mm/yyyy):

**ADVISOR**