Overview of Automotive Electronics Lab

Sl. No.	Experiment name	Purpose & overview of the experiment
1	**Antilock breaking system development & testing**	Gain the deeper insight of control engineering & system development using embedded systems in Automotive technologies. Learners will be able to understand the system architecture, system behaviour & system control. Step 1: Modeling the ABS System in Scilab/Matlab to study the system behaviour with various conditions for speed, brake torque & slip. Step 2: Perform the hardware test to collect & compare the results with Models results in Scilab/Matlab Step 3: Controller algorithm development for ABS tuning
2	**PMSM/BLDC motor control & algorithm development**	Gain the practical insight of motor controls, motor behaviour, tuning & calibration & develop the control models using Matalb Simulink Learners will be able to understand the scope of motor controls & calibration. Appreciate the need for MDB in controller development Step 1: Build the Matlab Simulink model of BLDC motor controls with closed loop PI control. Perform test cases to study motor response. Step 2: Perform the above test cases on real hardware, log the data & compare the model & real hardware results Step: Tune the control for the system & improvise
3	**Stepper motor control for the IAC application**	Gain the practical application of stepper motor & controls for real world applications. Learners will be able build a real application of stepper motor for IAC application. Step 1: Build the Matlab/Simulink model of IAC valve for various loads Step 2:Develop the control algorithm for stepper motor control
4	**Automatic control of actuators**	Gain the exposure to understand the need for automatic control of actuators for various automotive applications
5	**Automatic wiper control**	Gain the application knowledge to auto control the wiper for various rain conditions such as low, medium & high rain. Develop the control algorithms for driving servo motor

Scope for future research & lab advancement	

For ABS lab
 	
 1. Advanced MBD of ABS for 4/6/8 wheeler applications using Matlab/IGP carmaker/Scilab
 2. Validation of Model data to real worldtesting
 3. Improvement of experimental setupwith Dspace/NI HIL systems
 4. Product development of ABS & control forreal worldapplications
	For Motor controls lab
	
	 1. Advanced control approach MBD suchas
	     a. Direct Torque control (DTC)
	     b. Field Orientation Control(FOC)
	     c. Field WeakeningControl
	 2. Labadvancement
	     a. Simulink to Embedded codegeneration
	     b. Load control andcalibration
	     c. HIL unit for motortesting
	     d. Real vehicle level control implementation

Stepper motor control 1. Real time integration & control forautomotive application or otherapplications 2. Advance MBD inMatlab 3. Advanced system tuning with variousload conditions	Wiper control and Sensors & actuators 1. Development of sequencing control for vehicle turn on/off, Charging, Crash, remote control etc.

Overview of the E-mobility Lab setup at Christ University

30/pi
rad/sec to rpm
Speed Comparison

W - Ang. Velocity
Angular Speed (rad/sec)
Speed

Elec Torque
Electromagnetic Torque
Torque

Input Voltage

A
Van

Iabc
Phase Currents
Phase Currents

B
Vbn

Eabc
Back EMF
Back EMF

Sector In   Comm Sequence
Commutation Logic

Fabc
Rotor Flux
Rotor Position based EMF

C
Vcn

Commutation Logic

Sequence
Commutation Sequence
Sector

Input

Inverter

BLDC Motor

VEHICLE

FRICTION
FORCE

WHEEL

ANGULAR VELOCITY
ANGULAR VELOCITY

SLIP

SLIP RATIO

FRICTION

FRICTION COEFF

CONTROL

BRAKE TORQUE

MUX

IAC BLOCK

ENGINE
BLOCK

Mdot_fi
Pm
Mdot_ap
Ma
Mdot_ai
Acc
E_T
W

Acc
E_T
W

W

MUX