**Lab Sheet 5: Modelling in Simulink**

Submit before the end of your week 8 lab session

# Aims

The aims of this lab are to:

* Practice the use of Simulink and Stateflow to model control systems.
* Understand the capabilities of hierarchical modelling and abstraction.

# Activities

Perform the following tasks and answer the questions on the answer sheet.

1. Task 0: Download and load the sample diagram.
2. Task 1: Verify the existing functionality.
3. Task 2: Add hazard warning lights.

## Task 0: Download and Load the Sample Diagram

Download the sample diagram. The diagram has the following features:

* Subsystems to model the interaction with the driver (“User Interface”).
* The main control algorithm (“Indicator control”).
* Abstract representations of the left and right indicator lights, respectively.

## Task 1: Verify the Existing Functionality

Run the simulation and review the output on the scopes. The intended modelling is such that an indicator is on (flashing) when its value is 1. The driver’s input (use of the lever) is encoded as -1 (right), 0 (off), and 1 (left).

## Task 2: Add Hazard Warning Lights

Arguably the indicator lights should also be flashing when used as hazard warning lights. As first step, add an additional output to the “User Interface” subsystem. This will model the button to be pressed by the driver. You may then either extend the control chart to take into account the value of the button, or add a separate control (and fuse the results of the two subsystems). Show via simulation that your system operates properly.

# Answer Sheet

*This sheet should be printed out and handed in during the lab session. It can be completed either electronically or by hand.*

|  |  |
| --- | --- |
| **Name** |  |
| **Student number** |  |
| **Date submitted** |  |

## Questions from The Lab

|  |  |  |
| --- | --- | --- |
| **Question** | | **Answer** |
| 1 | What is the data type of the lever’s control signal (“Position”)? | double |
| 2 | Which state is the stateflow chart “Control” in after the “indicator” input sequence [0, -1, -1, 1]? | Off |

## Viva Record

Task 1: Demonstrate simulation of the indicator lights.

Task 2: Demonstrate simulation of the hazard warning lights.

|  |  |
| --- | --- |
| **Viva comment (completed by TA / lecturer)** |  |
| **Name:** |  |

## Question about concepts

Answer the following questions concisely (up to 30 words each):

1. Give three examples of what might be a “model” in the software-development process, and describe what their specific intended uses are.

Structure 🡪 UML: model oriented object

Behaviour 🡪 Stateflow: models state flow charts

Process: description of activities and processes

1. What is the role of an oracle in model-based testing?

Observe the progress of the implementation and mark it as pass of fail (to improve the model).

## Feedback

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|  | | |
| **Marker** | **Date** | **Grade** |
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