Deliverable exercise FC: Compound Pendulum

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Work 4

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2 Design of the Fuzzy Controller

2.1 Membership functions

- Error:

- Error Derivative: TODO comment on how we changed the error derivative to [-15 15] from [-5 5] Reason: it was out of bounds, and the fuzzy controller returned 0 in the Simulink simulation

- Thrust:

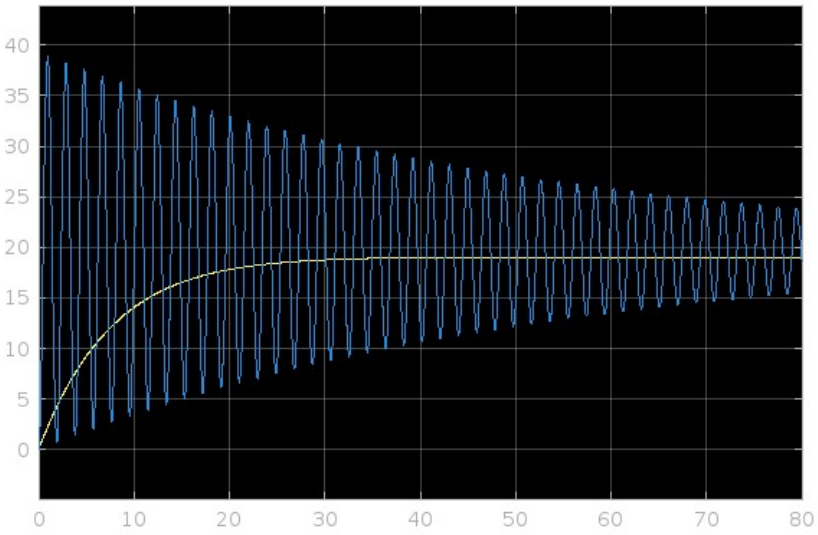
Maybe comment about that defining the lowest (and highest) membership function as a triangle (which decreases after reaching its maximum, if we further decrease it: see screenshot) is not a good idea in our opinion as it is not realistic, but we did it this way to follow the instructions since, it was defined as a triangle in the exercise.

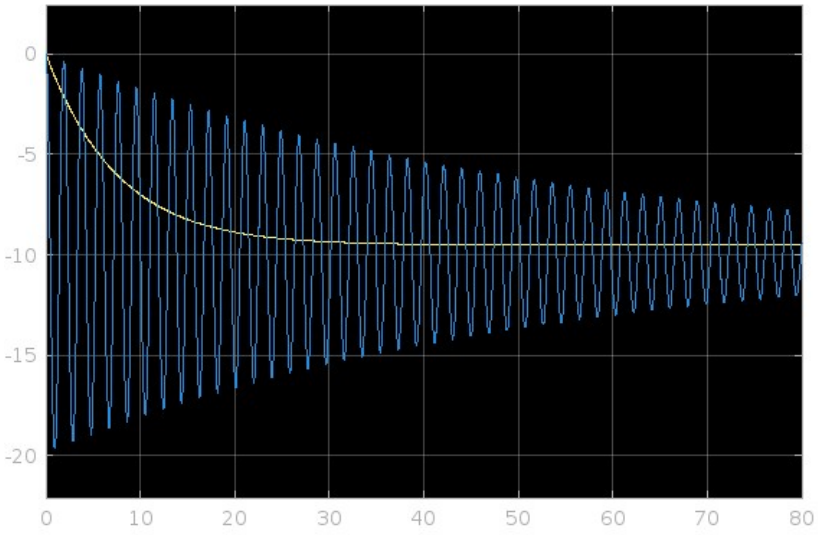
2.2 Rules

Rule	**Weight**
If Error is Negative and ErrorDerivative is Decreasing then Thrust is Negative	1
If Error is Zero and ErrorDerivative is Decreasing then Thrust is Negative	1
If Error is Positive and ErrorDerivative is Decreasing then Thrust is Positive	1
If Error is Negative and ErrorDerivative is Stationary then Thrust is Negative	1
If Error is Zero and ErrorDerivative is Stationary then Thrust is Zero	1
If Error is Positive and ErrorDerivative is Stationary then Thrust is Positive	1
If Error is Negative and ErrorDerivative is Increasing then Thrust is Negative	1
If Error is Zero and ErrorDerivative is Increasing then Thrust is Positive	1
If Error is Positive and ErrorDerivative is Increasing then Thrust is Positive	1

Table 1: Rules and Corresponding Weights

3 Results





4 More complex controller

(with at least 7 membership functions)

TODO: "Explain and reason what happens if you increase the number of membership functions (7 or more) of the output?"

It doesnt talk about it, but if we design the 7 membership functions and the rules, we can implement it in another controller, and run the simulation to see what happens. I've created pendulum-fuzzy-complex.fis, but so far it is the copy of the original, nothing is modified.

5 Conclusions

References