

## Neural Networks

The neural networks considered in [1] are a Multilayer Perceptron (MLP) and an Extreme Learning Machine (ELM).

Both models were trained in Python. In the first case, obtaining the trained model in a `.onnx` format was possible. This format can be easily imported into MATLAB where the simulations including the MLPs in the Vertical Stabilization control loop of the ITER magnetic control system have been performed. Specifically, the MLP in `.onnx` can be imported and converted into a `.mat` file which then can be used in the Predict block in Simulink.

In the case of ELM, the training consists of obtaining the value of parameters and matrices of the ELM equations (5a) and (5b) in [1]. They can be exported directly in a `.mat` file and then used to compute the ELM output at each time step.

## References

- [1] S. Dubbioso, A. Jalalvand, J. Wai, G. De Tommasi, E. Kolemen, "Model-free Stabilization via Extremum Seeking using a cost neural estimator," *Expert Systems with Applications*, vol. 258, pp. 125204, August 2024.