

ABB-Data driven modeling for control of industrial systems

Process model development and optimization is one of the prioritized direction in the automation industry research. Process model development includes both analytical and data based modeling. Recent advances in analytics for Big Data and Artificial Intelligence open up new possibilities to develop efficient and robust data based models.

This process is supported by ABB ability initiative, where the first step is to collect and store data from the sensors installed on equipment and then use these data to create models replicating behavior of the systems. Additionally, it is important to optimize these data based models which will allow to operate the systems in the optimal way. The problems under consideration are :

(a) Create a model based on input and output data collected from the operations of a propulsion system. These input/output data should be used to create the model which will be used instead of the analytical model to operate the propulsion system in an optimal way. This model could be regarded as a regression model where the input data fit output in the best possible way.

(b) Additionally, for the purpose of development of control techniques, the model which reverts the initial model in a way that output data are used to fit the input, is of big interest.

(c) This part requires some extra analysis since the function mapping the input into output is not one-to-one function but a surjective function, meaning that different input values can be mapped to the same output. Thus the question about the adequacy of the inverse model is quite important. It is supposed that the problem is solved in MATLAB using the predefined functions from the Neural Network Toolbox.

The problem is regarded to be solved, if (a),(b) and (c) are addressed. Part (c) might require extra analysis answering the question about the possibility to create an adequate inverse model.

The conclusions should answer the following questions:

1. The best neural network model (a). "Best " in this context is the most robust, fast and accurate network.
2. Whether or not it is possible to create an adequate inverse model (b). If so, which model is the best. "Adequate" means the model replicating the input values of the model (a) in an accurate way. Here, the problem of surjection of the model (a) should be investigated.

The data will be given and are MATLAB compatible. Input describes the values of three parameters and output describes the 3 characteristics of a given the propulsion system. The motivation is to create inverse models using neural networks. These models should be robust and accurate to be used as a part of control schemes which will be implemented to control the propulsion systems in an optimal way.