Model Fitting in Frequency Domain Imposing Stability of the Model

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System identification is a powerful technique for constructing accurate models of complex systems from noisy input-output observations. It mainly consists of three basic steps that are interrelated:

1. design of the experiment;
2. choice of a parametric model (black box or physical laws);
3. the estimation of the model parameters from noisy measurements.

According to the intended goal of the identification experiment - physical interpretation, simulation, prediction, or control - some additional properties may be imposed on the identified model such as reciprocity, passivity, stability, ...

This thesis presents both theoretical (theorems) and practical (algorithms) contributions to the third step of an identification experiment: the estimation of guaranteed stable models from noisy data.
A two step procedure is proposed: in the first step an unconstrained model is identified from the noisy measurements. Next, if unstable, the unstable model is in a second step approximated by a guaranteed stable model by adding an appropriate delay to the target function. The final result is a stable model with bias and noise uncertainty bounds that is useful in open loop simulation or prediction applications.