MIDÉ

DYNAMOD

PRODUCT INFORMATION

Reliable High Order System Identification

DynaMod, a powerful software package developed by Midé, provides a simple but reliable means of obtaining linear system models for highly complex systems. It performs system ID on high modal density, sensor/actuator-rich linear systems.

System identification is a crucial component in:

1. **Measurement model-based control**
2. **Analytical model tuning**
3. **Experimental identification**

DynaMod provides unmatched accuracy and ease of use whenever high order dynamic systems must be modeled. It is a vital tool for control design, and is also useful for parameter identification and physical model updating.

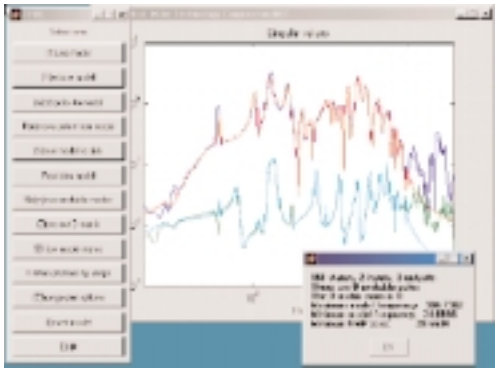

Figure 1: Example of a 161 state structural/acoustic model used for acoustic quieting of a launch vehicle shroud test fixture

Simple, Powerful Operation

DynaMod is driven by a pair of powerful and robust code engines, namely:

- the Frequency-domain Observability Range Space Extraction (FORSE) algorithm, which automatically generates a state space model from frequency domain data
- a Log-Least Squares (LLS) search algorithm which refines the model.

A clean, clear Graphical User Interface (GUI) is wrapped around the FORSE and LLS engines. The interface belies the power of the identification tools, presenting all of the fit quality information in an intuitive format which instantly communicates the user interaction required to improve the fit.

Novice users can create virtually perfect models the first time they run DynaMod.

Control

Measurement-based control achieves the highest control system performance, because the design model is based on the true system.

- An accurate characterization of transmission zeros and of the roll-off (high frequency) region is vital, since these typically represent the closest approaches to the Nyquist point, and thus the smallest gain and phase margins.
- Both regions are poorly captured by many conventional ID algorithms, since the response is often orders of magnitude smaller than the response near resonances, and thus is insignificant in the optimization cost.
- DynaMod's LLS tuning algorithm helps to ensure that low magnitude response regions are weighted on an equal basis with high magnitude regions, and thus that all regions are captured accurately.
- This capability is enhanced by the ease with which the user can interactively modify the model.
- As a result, model accuracy is limited only by the quality of the data.
- Equally important for computer implementation, the same powerful tools are available for continuous-time and discrete time systems, transparently to the user.
- Identification also plays an important role in tuning an analytical mode, such as a Finite Element model.
- An analytical model will always contain errors in frequency and damping, arising from incorrect modeling assumptions, mismodeled parameters, nonlinearities, and other effects. The model must be corrected against the measured system. DynaMod facilitates this tuning with a variety of options for constraining frequencies and mode shapes. This approach has been used by Midé to identify and reduce steering wheel vibrations via structural redesign.

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Company Background

Midé, active primarily in the aerospace, automotive and manufacturing industries, is known for its ability to conceptualize, design and deliver high performance systems that are tailored to the user's specific application. System components, whether custom designed or sourced from suppliers, are integrated through Midé's extensive suite of expertise in the fields of electronics, actuation, sensing, control, system design & integration.

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Experimental Identification

Accurate knowledge of system response can be crucial in its own right.

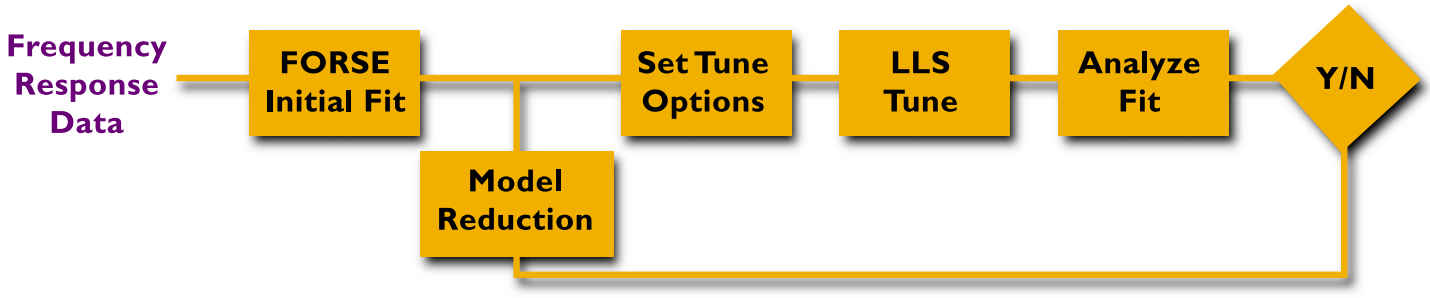
Example: the NASA-Langley Active Wing Testbed - a scaled down fighter wing with embedded actuation - is being used to investigate flutter control. Flutter is a potentially catastrophic interaction of structural and aerodynamic forces which occurs at the coalescence of two distinct vibration modes. In flutter, aerodynamic forces destabilize one mode. Flutter prediction therefore relies on accurate damping ratio estimation of closely spaced modes, where conventional methods of estimating frequencies and damping ratios break down. DynaMod is particularly well-suited for high modal density, lightly damped systems. Using DynaMod, the flutter speed of the Langley wing was predicted to within 5% of the experimentally measured value.

Reliable High Order Model Generation

Each of the code engines is inherently well-conditioned for large order problems. The FORSE code is built around a Singular Value (SV) decomposition, while the LLS algorithm uses a numerically robust parameterization. Model order and input/output dimension are, in practice, limited only by available computing power.

Pricing

For further pricing details, please contact Midé (details below). Note that Mide pays royalties to MIT's Space Systems Laboratory.



Intuitive structure generates high order models with minimal user effort

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