Frequency Domain System Identification Toolbox 4.0

for use with MATLAB®

The Frequency Domain System Identification Toolbox (fdident) provides tools

- to measure, identify and evaluate *linear models* of dynamic systems, and
- to evaluate and characterize *nonlinearities* of a dynamic system.

The procedures can be executed either by working with an easy-to-use graphical user interface (GUI), or in the command-line. Objects allow smooth data and model exchange with MATLAB's control design toolboxes and its System Identification Toolbox.

The toolbox is a collection of frequency domain based procedures. Arbitrary signal forms (even random noise and nonperiodic data) can be properly processed with elimination of leakage or transient effects. Identification starts from either time domain measurements (time series) or frequency domain data (FRF measurements). Model validation incorporates different tests in the frequency domain.

KEY FEATURES

- **user-friendly graphical user interface**
  - ➢ detailed on-line help,
  - ➢ guidance for novice users at every step,
  - ➢ zoom-in to many details,
  - ➢ default settings suggested at each step,
  - ➢ model scan: this allows an automatic modeling procedure, so that even unfamiliar users can get reasonable models,
  - ➢ action recorder to record and repeat any action sequence.
- **powerful algorithms**
  - ➢ fully automatic nonparametric analysis
  - ➢ automatic model selection,
  - ➢ high-order system identification (up to 100 poles and zeros), e. g. for modal analysis,
  - ➢ random or nonperiodic signals can also be processed.
- **easy handling of data and models via built-in objects**
  - ➢ compact storage of data and settings
  - ➢ model saving as Control System Toolbox object
- **simple and logical command-line call forms**

This version *keeps all the functionalities* of the earlier releases of the toolbox (all command-line calls), and builds a new, powerful tool on top of it.

Help on selected object

3-D plots of criteria of different models

Lin/log frequency axis

Type of selection criterion

Load new data for cross validation

Status bar

Error plots for comparison

Aspect of plot

Coupled/ decoupled view

Main properties of models

Graphical comparison of two models

Accept selected model and close window

Model validation and comparison

STEPS OF IDENTIFICATION

The Frequency Domain System Identification Toolbox follows the whole identification procedure:

- design of periodic excitation signals,
- preprocessing of data,
- extraction of high quality nonparametric models,
- identification of continuous-time or discrete-time systems with fractional delay,
- model order selection,
- calculation of confidence intervals of magnitude, phase, and poles/zeros,
- model validation, residual analysis,
- simulation.
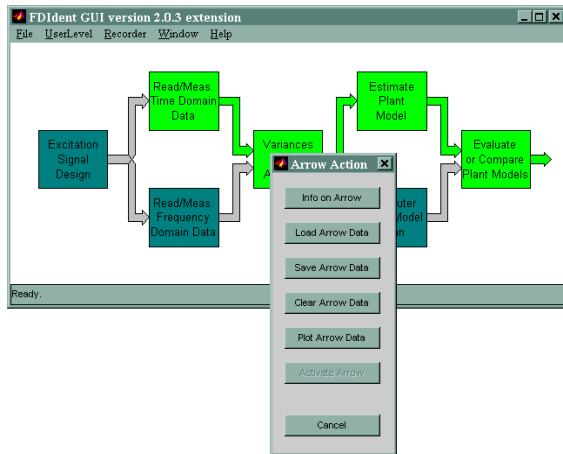
The starting window of the graphical user interface with the arrow-action window which comes up when double-clicking to an arrow

IDENTIFICATION AND FREQUENCY DOMAIN

System identification determines a transfer function model of a system from measured data. Fdident solves the relevant equations in the frequency domain, starting from time domain or frequency domain data, yielding a model of an s-domain or z-domain transfer function. Its attractive features are:

- directly understandable for engineers and scientists,
- straightforward physical interpretation of s-domain parameters,
- easy frequency band selection,
- made free of the effects of leakage, transients, and randomness of excitation,
- effective noise reduction and data compression,
- improved signal-to-noise ratio,
- use of all information present in the measured signals,
- consideration of both output/input observation noises,
- proper identification of systems in a closed loop,
- automatic elimination of DC offset,
- automatic noise characterization and generation of uncertainty regions.

ANALYZING NONLINEARITIES

- Are there nonlinearities in the system?
- What nature and what level the nonlinearities have?
- Can estimation errors be explained by the nonlinear behavior?
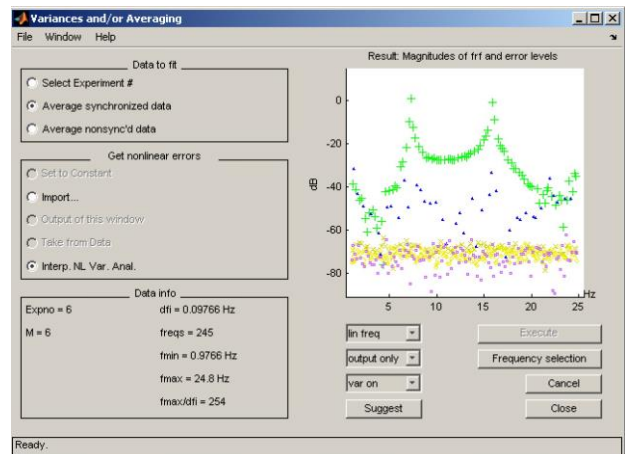
Data preprocessing results analyzing nonlinearities of a system with a randomized-grid multisine.
yellow marks: noise level, blue triangles: odd nonlinearities, magenta squares: even nonlinearities
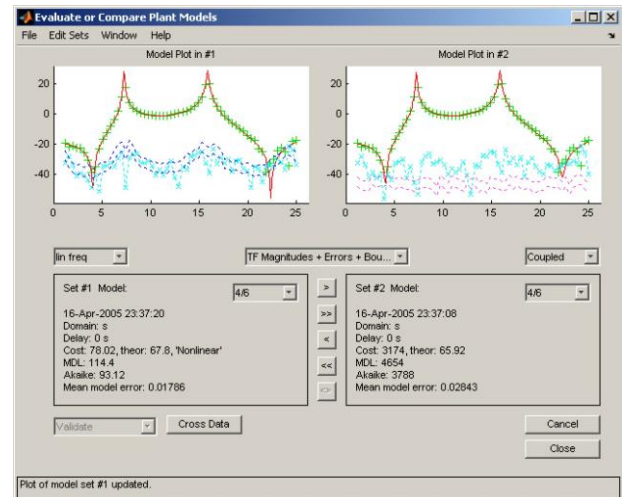
Parallel residual analysis of nonlinear-based and linear-based identifications. The left plot shows that the error levels are acceptable with nonlinear analysis, while in the right plot the errors of the linear fit are beyond acceptability limits.

More information:
URL: http://fdident.x2con.com
Distribution: http://fdident.x2con.com/fdident_pricing.html
Third party Mathworks website:
https://www.mathworks.com/products/connections/product_detail/frequency-domain-system-identification-toolbox.html
Email with technical questions: **fdident@vub.ac.be**
Email concerning distribution: **fdident@x2con.com**

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