LRM for multivariable and position-dependent mechanical systems

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LRM for multivariable and position-dependent mechanical systems
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FRF identification
FRFs have a central role in identification and control of motion system and are used for:
1. obtaining basic information on the system: resonances, nonlinearities, etc.,
2. direct controller tuning and validation, and
3. as an intermediate step in parametric identification.

New class of methods for improved FRF identification ⇒ Local parametric approaches [1]:
- LRM [2,3]: improved quality around lightly damped resonances compared to LPM
- MIMO LRM ⇒ open aspect: parametrization

key mechanism: exploit smoothness over frequencies

MIMO LRM parametrizations
Different parametrizations for $G(w) = D^{-1}(w)N(w)$:
- MISO: $D(w) = \text{diag}(d_i(w))$
- Common denominator: $D(w) = I_{n_u} d_c(w)$(
- full MFD $D(w) = D_0 + D_1 w + \ldots$
- integer (low) order MFD

⇒ analyze methods on simulations and benchmark data
- $4 \times 4$ simulated system
- MFD variant overall best performance, especially around resonances
- All LRM variants outperform spectral analysis and LPM estimates

- Experimental benchmark data of AVIS [4]
- Analyse efficiency of MIMO LRM compared to standard techniques

nD-LRM for position-dependent models
Mechanical systems often position-dependent due to motion ⇒ nonlinear / LPV behavior.
Here: local modeling, i.e., “frozen” in fixed operating point ⇒ behavior smooth over frequency and scheduling domain.
key mechanism: exploit smoothness in scheduling domain [5]

Ongoing work
- user friendly algorithms
- parametric modeling and control (poster Rozario A16)

References

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