PNLSS Identification

Post TRC Institute Meeting 5

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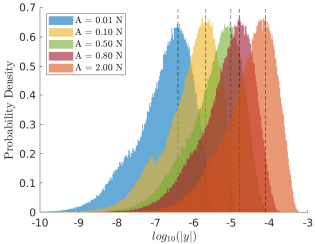
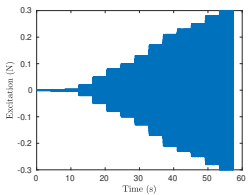
Overview



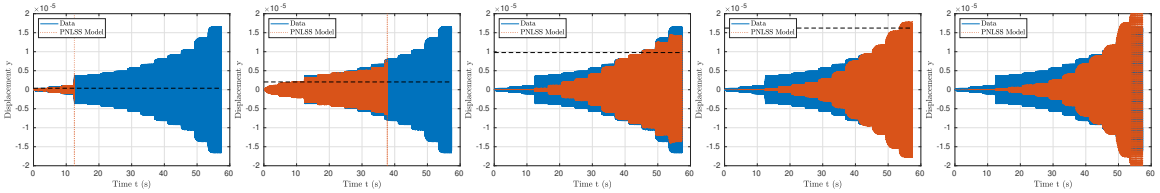
(a) Multisine Data Extent



(b) PLL Excitation

- Current set of slides contain results for **benchmark 4**, the beam with elastic dry-friction element
- The left shows a histogram of the magnitude of the multi-sine response data
- PNLSS models using this data is used to train the initial guesses for the identification on the PLL data
- PNLSS optimization is conducted using the **FULL DATA** from the simulated experiments, i.e., **this includes the transients** inherent
- This procedure was adopted since it maximized the amount of data we used for PNLSS

Multi-sine PNLSS models: Performance on PLL data I

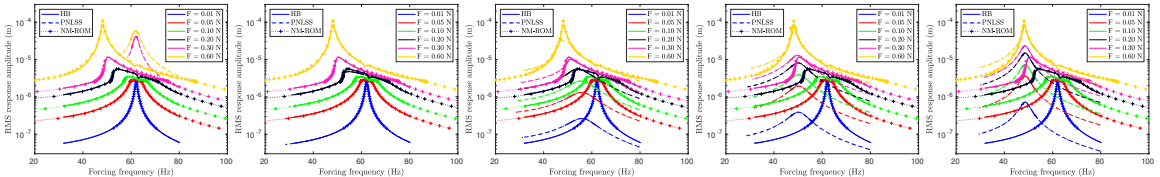


(a) A = 0.01 N (b) A = 0.10 N (c) A = 0.50 N (d) A = 0.80 N (e) A = 2.00 N

Figure: Time domain performance on PLL excitation

- Note that identification was carried out on **multisine data**. We're now just looking at how those models perform on the pll data
- Black dashed line indicates "mode" of the multi-sine response amplitude used for training the PNLSS models in each case
- Note that the models identified with the lower levels (A = 0.01 N, 0.1 N) seem to be unstable beyond a certain point

Multi-sine PNLSS models: Performance on PLL data II



(a) A = 0.01 N (b) A = 0.10 N (c) A = 0.50 N (d) A = 0.80 N (e) A = 2.00 N

Figure: Corresponding frequency responses of the PNLSS models employed before

- The procedure used for training these PNLSS modes was:
  - BLA from A = 0.01 N data set as initial guess model for PNLSS on A = 0.01 N data set
  - PNLSS on A = 0.01 N set as initial guess model for PNLSS on A = 0.10 N data set, etc.

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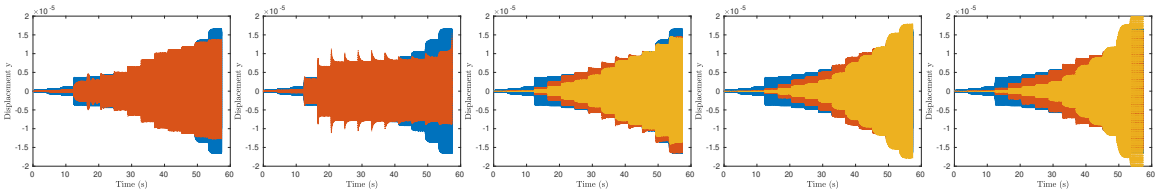
PNLSS Trained on PLL data with different multisine PNLSS models as initial guesses I

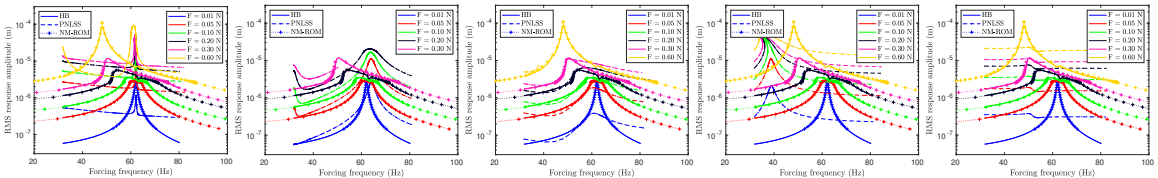


(a) A = 0.01 N (b) A = 0.10 N (c) A = 0.50 N (d) A = 0.80 N (e) A = 2.00 N

Figure: PNLSS optimization on PLL data

- We're now looking at the performance of PNLSS models trained with PLL data.
- **Top**: Yellow is initialized model; orange is PNLSS-optimized model
- Note that the jacobian apparently has NAN's for PNLSS models trained with very low amplitude data (A = 0.01 N, 0.10 N). I had to re-initialize the non-linear coefficients in this case

PNLSS Trained on PLL data with different multisine PNLSS models as initial guesses II



(a) A = 0.01 N (b) A = 0.10 N (c) A = 0.50 N (d) A = 0.80 N (e) A = 2.00 N

Figure: Frequency responses of PNLSS models optimized on PLL data. Different subfigures indicate different initializations.

- Although, the model initialized at A = 0.50 N seems to capture the stiffness non-linearity, it does not represent the amplitudes very well.
- *I am not sure if this is indication that the elastic-dry friction non-linearity may not be captured using the polynomial bases in PNLSS.*