PNLSS Identification

Post Institute Meeting 1

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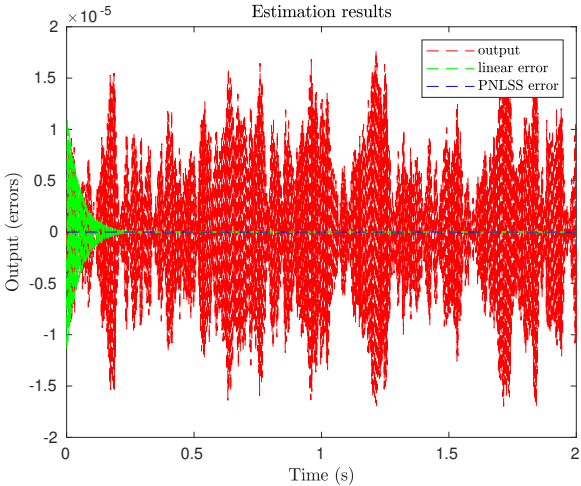
Overview

- The main issues we were previously having with the PNLSS identification were:
  1. **Forcing levels leading to periodic input $\implies$ non-periodic response:** PNLSS was unable to identify the model to sufficient error even in the time domain
  2. **Identification of frictional systems:** Identified models seem to perform better only around the regime of response contained in the training data
  3. **Implementation of output-only non-linearities:** Not very reliable. Questions:
     - Has to be non-hysteretic?
     - Linearity in coefficients?
     - Is this even appropriate for friction non-linearities?
- Currently focused on aspect 1: Investigation of non-periodic responses.
- The suggestion was to try to increase the damping to reduce such a regime.

Periodic Input - Non-periodic Response I

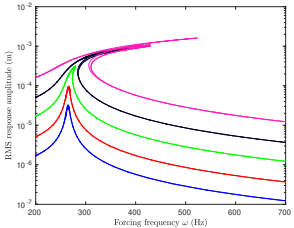
Training using Data With Transients

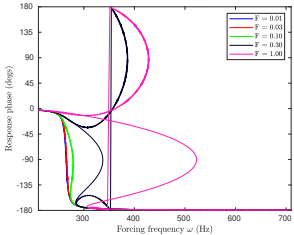


- Found routine `fLMnlssWeighted_x0u0` which estimates initial conditions along with parameters
- This could be used to successfully train transient data for the Duffing problem (see left)
- $n_x = [2, 3]$ used here

Periodic Input - Non-periodic Response II

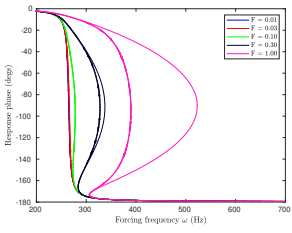
Training using Data With Transients



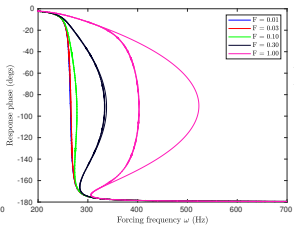


A = 0.01

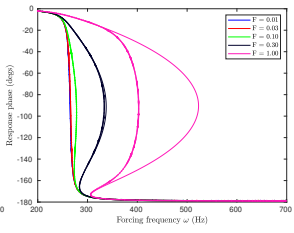
- The data has response with peak amplitude 2×10^{-4} m
- The identification works fine until the required response level on the frequency response diagram is about one magnitude higher than this
- The damping factor has already been increased



A=0.25

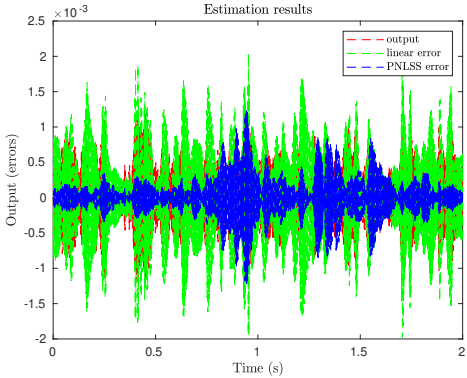


A=0.50



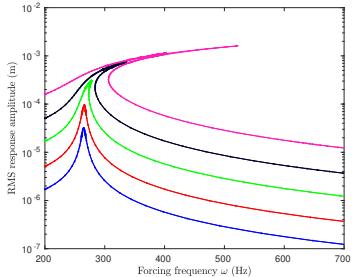
A=0.75

Periodic Input - Non-periodic Response

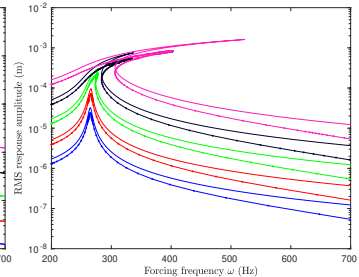


- These issues persist even upon increasing the number of states to $n_x = [2, 3, 4, 5]$

- For the larger amplitude case (when the response seems to lose periodicity), PNLSS is unable to perform very well
- This is also reflected in the frf's:



A=0.50



A=0.75