Learning Aircraft Spin Dynamics from Measurement Data Using Hankel DMDc with Error in Variables

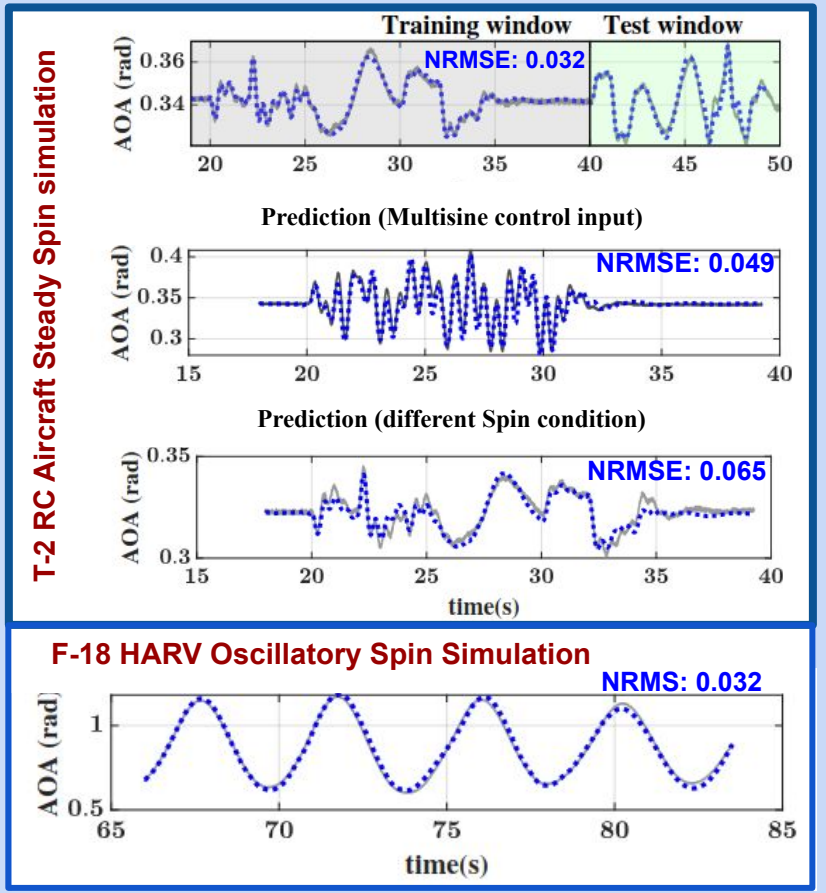
Balakumaran Swaminathan & Joel George Manathara

Motivation: Traditional aircraft spin motion modeling depends on extensive and costly wind tunnel testing. Data-driven approaches remain underexplored in this area.

Methodology: Hankel Dynamic Mode Decomposition with Control (Hankel DMDc) is adapted with two modifications: Total Least Squares and Bias Elimination Least Squares for improving accuracy by addressing errors in variables.

Highlights:

- Two novel modifications to Hankel DMDc introduced to improve accuracy by addressing errors-in-variables.
- Validation on a nonlinear system with limit cycle oscillations: The standard method's trajectory diverged significantly, highlighting the need for these modifications.
- The modified algorithms accurately modeled steady spin (NASA T-2 RC) and oscillatory spin (NASA F-18 HARV) motions, achieving low prediction errors even with varied inputs and initial conditions.



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