

Damper Analysis

Michael Huntley

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Personal Background



- From New Hartford, Iowa
- Recent Graduate of Iowa State University
- Sponsored by the Southwest Research Institutes UTSR program



SOUTHWEST RESEARCH INSTITUTE

Work with James and Zach to develop an ANSYS based model of dampers and compare the results to test data

Damped Background

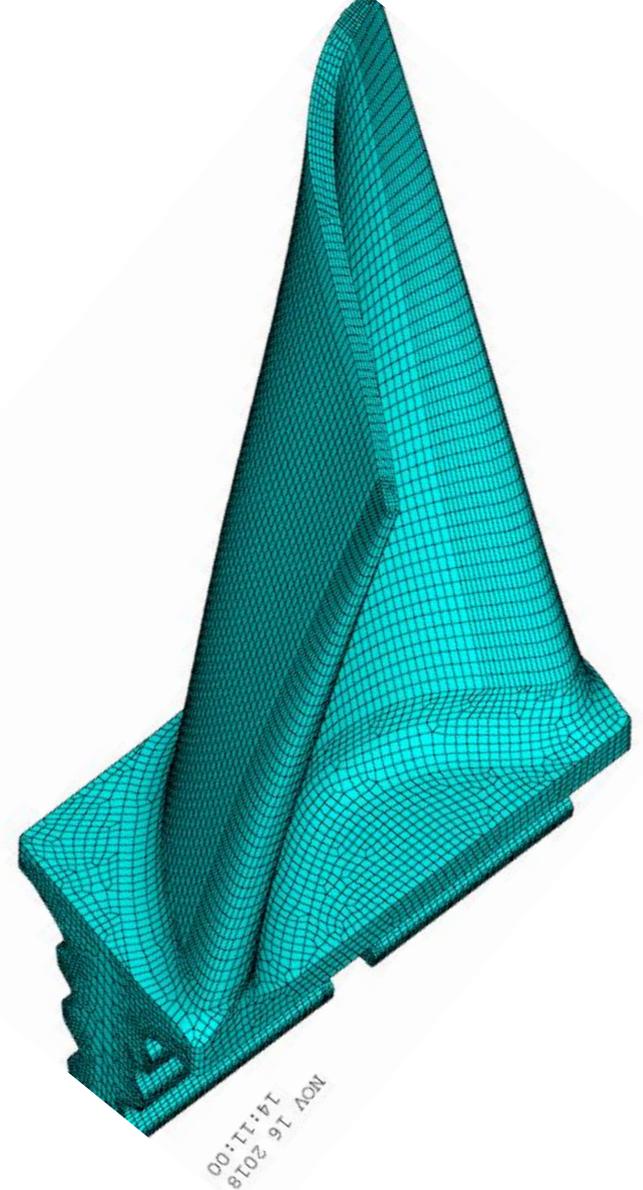
- Gas Turbines use dampers in turbine and compressor blades to reduce resonance response
- Previous test work conducted on damper designs
- Needed computational damper model for analysis

Modelling Intro

- FEM-based tool for prediction of:
 - Nonlinear boundary conditions
 - Vibratory frequencies
 - Displacements

ANSYS B.C.

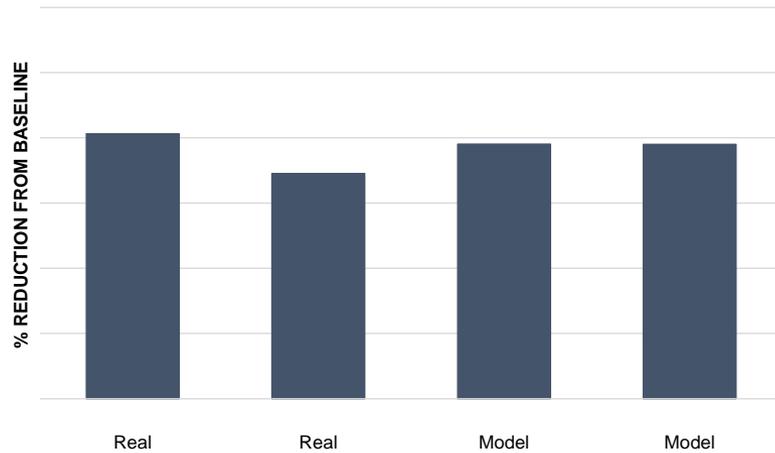
- Blade Only
 - Reduce complexity
 - Reduce run-time
 - Relative motion between blade and damper remains the same
- Fixed displacement at pressure faces
- Angular Velocity (varied)



Results

Damper Analysis Results

Damper 1 Real vs Model



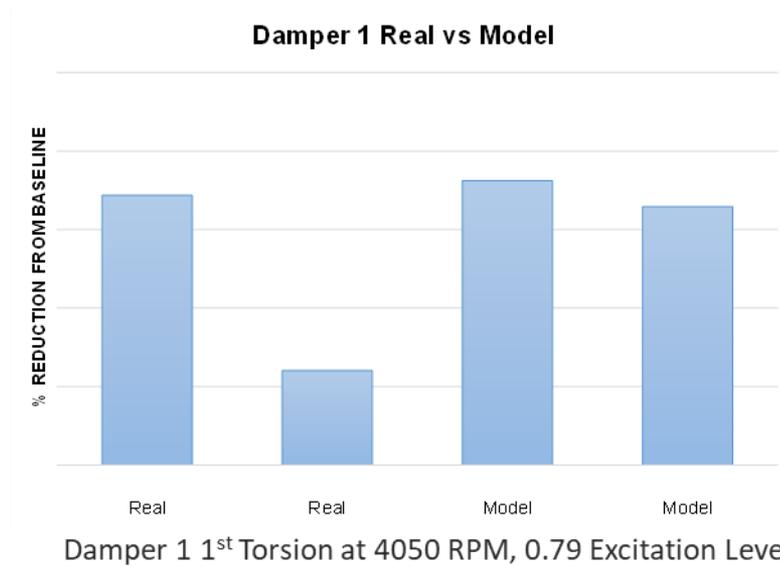
Damper 1 1st Flex at 2450 RPM, 0.645 Excitation Level.

Damper 1 Real vs Model



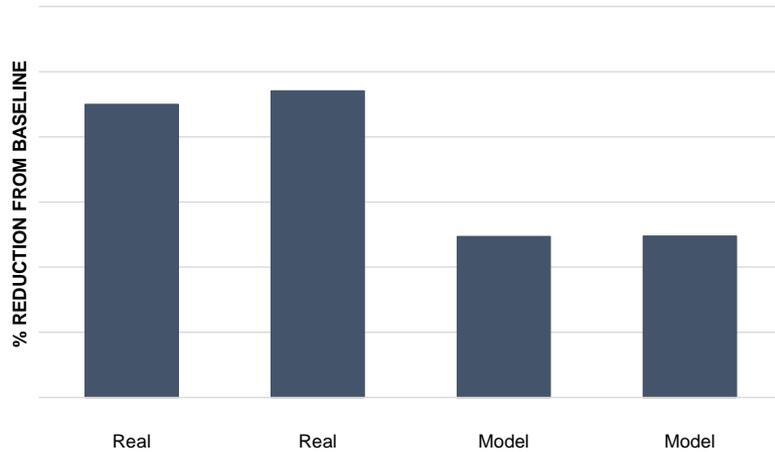
Damper 1 1st Flex at 4150 RPM, 0.35 Excitation Level.

Damper Analysis Results



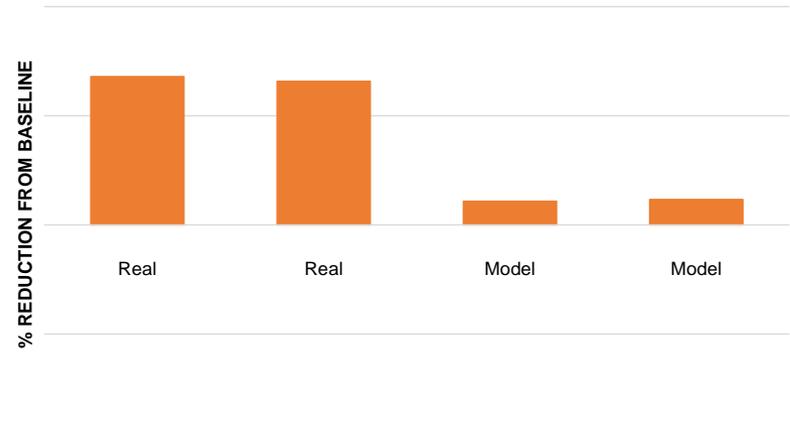
Damper Analysis Results

Damper 2 Real vs Model



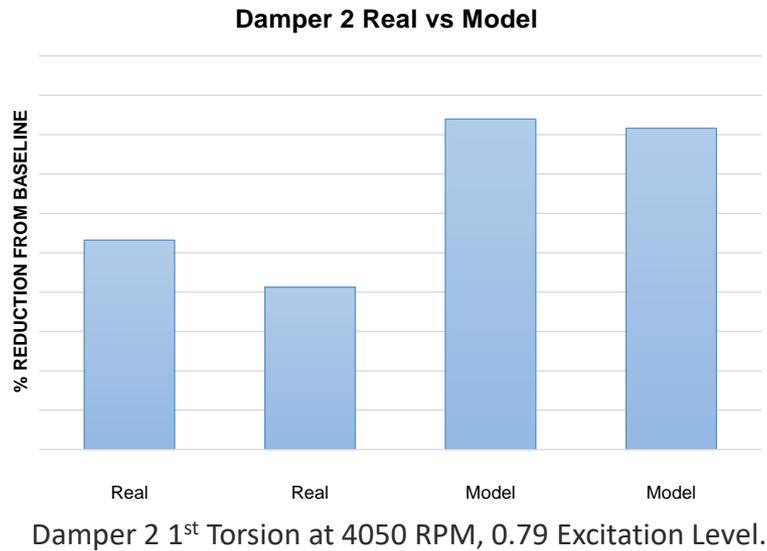
Damper 2 1st Flex at 2450 RPM, 0.645 Excitation Level.

Damper 2 Real vs Model



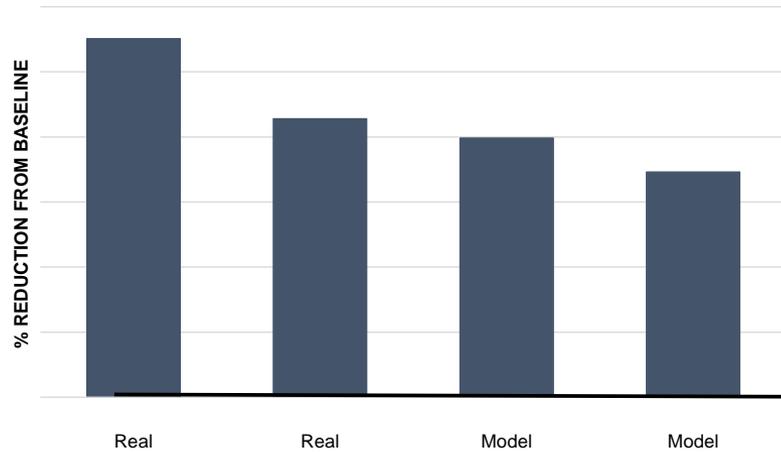
Damper 2 1st Flex at 4150 RPM, 0.30 Excitation Level.

Damper Analysis Results



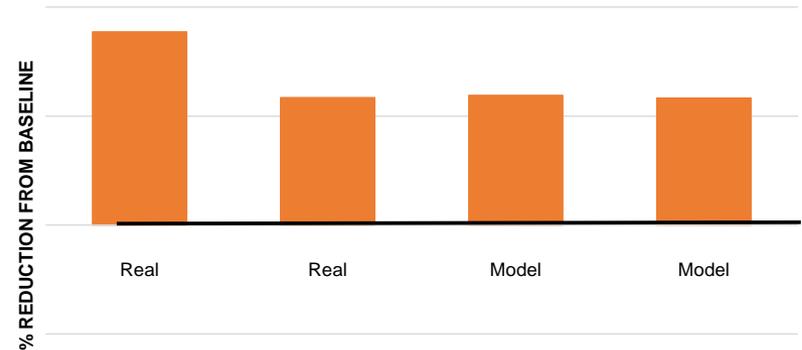
Damper Analysis Results

Damper 3 Real vs Model



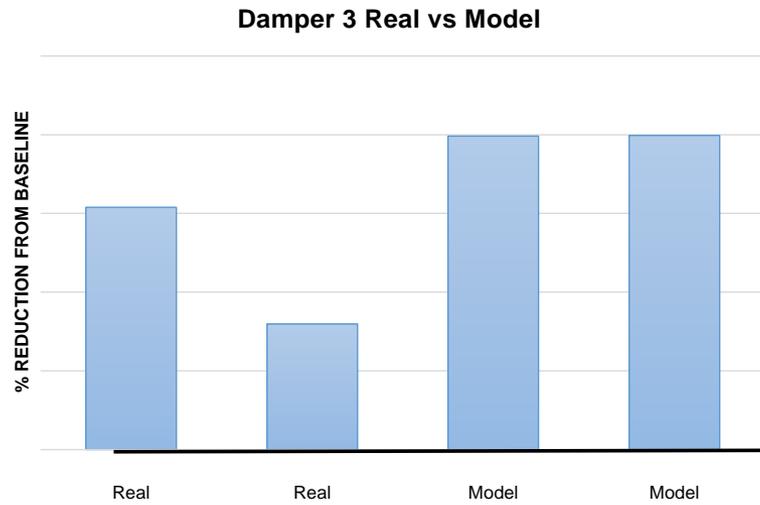
Damper 3 1st Flex at 2450 RPM, 0.645 Excitation Level.

Damper 3 Real vs Model



Damper 3 1st Flex at 4150 RPM, 0.35 Excitation Level.

Damper Analysis Results



Damper 3 1st Torsion at 4050 RPM, 0.79 Excitation Level.

Result Summary

- Models follow test trends with excitation and test speed give range
- Adjust parameters to more closely match test data reword
- Uncertainty in test result

Limitations, Future Test Cases, & Improvements

Future Test Cases and Improvements

- Improve Static Contact Analysis Results
- More complex designs
 - ANSYS contact pair limits
- Blade shaft displacement versus time results
- MCS model comparison
- Analyze which damper slip is occurring

Overall Experience

Overall Experience

- Improved skills with ANSYS Classic
- Learned the analysis software, ran complex analysis
- Gained experience with gas turbine design and aeromechanic analysis

Questions?