RAY W. HERRICK LABORATORIES

Mechanically Dissipating Targeted Vibrational Modes within Turbomachinery

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Sponsor: N/A

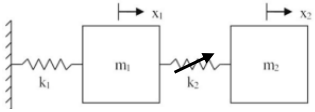
Project Description

Objectives
- Utilize mechanical, nonlinear bi-stable structures or absorbers to mechanically dissipate vibration modes in bladed disks
- Utilize the hysteresis in nonlinear vibration to harness and repurpose energy to dissipate targeted modes

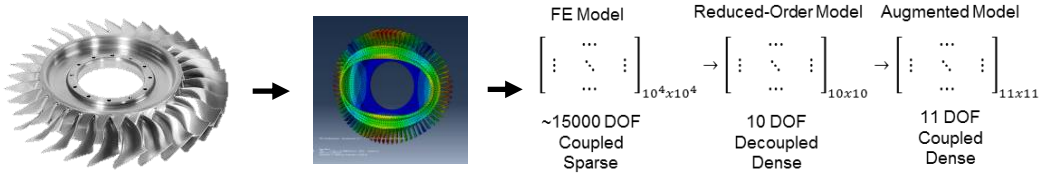
Impact
- Reduce/eliminate concerns of primary modes within operating conditions
- Extend life cycle
- Increase efficiency

Approach

- Show that switching stiffness can be used to dissipate resonances



- Create a reduced order model of a bladed disk to identify primary modes
- Design bi-stable element and apply to reduced order model to create an augmented model

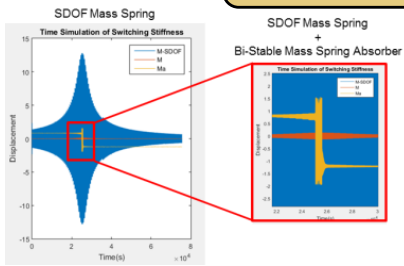


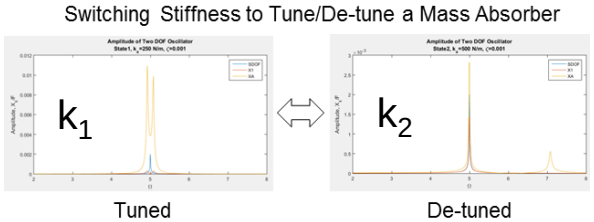
- Scale back to complex, bladed-disk model to see impact and check design
- Manufacture and test

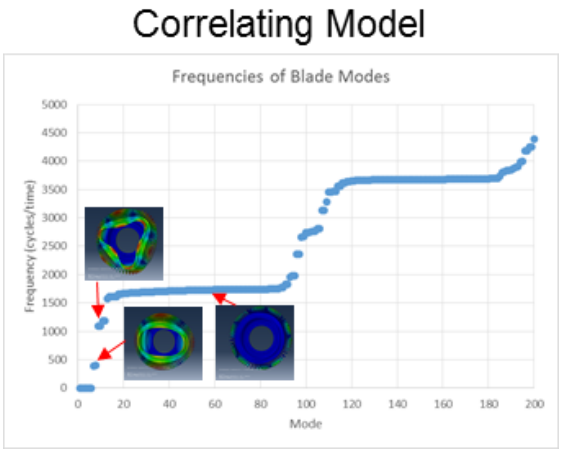
Discussion

Design bi-stable structures to target particular modes	→	Feasible, design targets are now needed
Reduce Bladed Disk Model to manageable size	→	Reduced Order Model (ROM) reduce 15000 DOF to 10 DOF
Beam Discretization Investigation	→	Application of Bi-stable spring/absorber to bladed disk ROM
Check Design	→	Scale back to physical size to apply to practical system

Results







Exploiting nonlinear, bi-stable structures to mechanically dissipate targeted vibrational modes within turbomachinery.

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