Multi-Harmonic Balance with Preconditioned Iterative Solver

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Robert J. Kuether, Sandia National Laboratories*
Andrew Steyer, Sandia National Laboratories*

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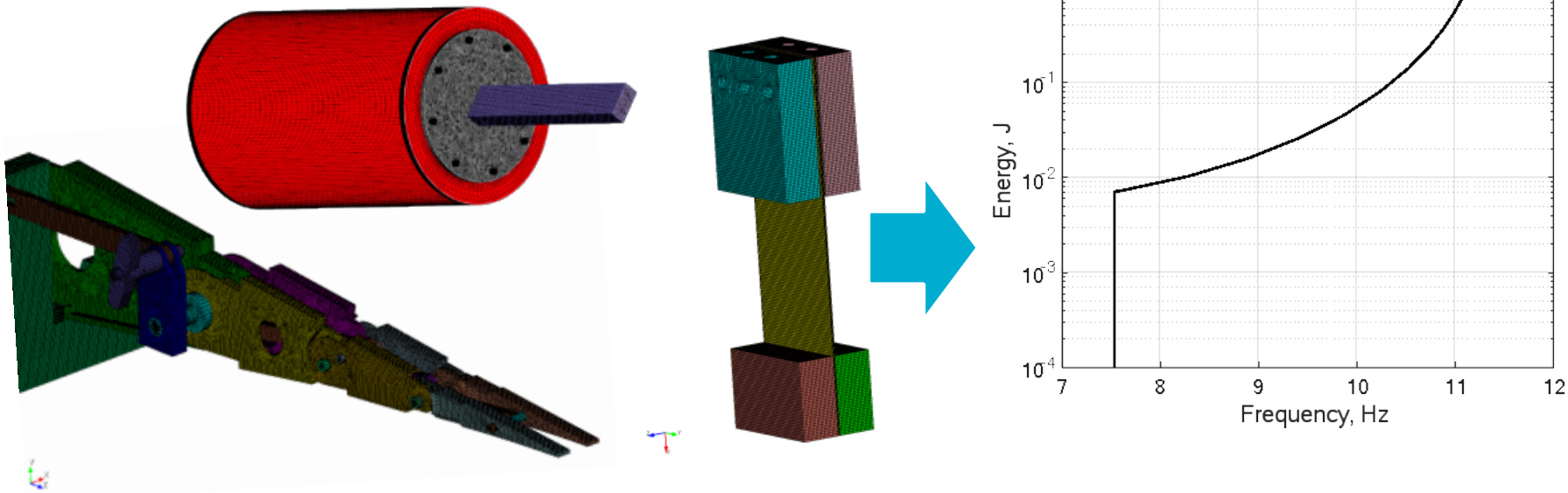
Seek to develop a scalable, Multi-Harmonic Balance algorithm to solve undamped NNMs of large-scale finite element models arising in computational mechanics/dynamics

- Inexact Newton Updates
- Preconditioned GMRES iterative solver

Selected preconditioner based on decoupled, block-diagonal form of the Jacobian allows for parallel matrix inversion on the order of FEM size



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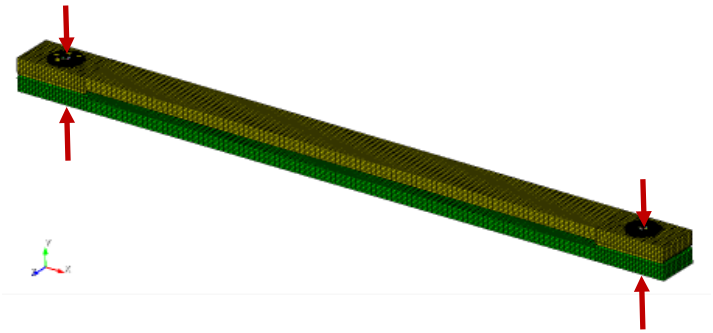
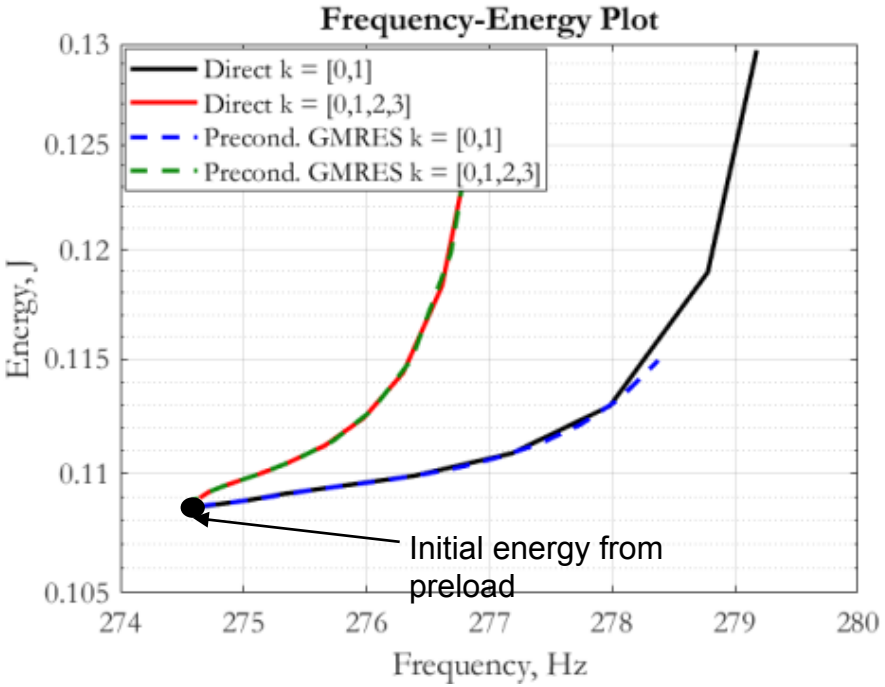


In one example with ~100K DOF, the **Preconditioned GMRES** solver produces accurate results at a significant cost reduction to the matrix inversion

- Higher harmonics needed to capture NNM
- Direct solve w/ Newton method grows in cost proportional to # Harmonics



2 · (# Harmonics) + 1*	3	5	7	9
Preconditioned GMRES**	15.1 s	16.0 s	16.4 s	15.7 s
Direct solve Newton	163 s	391 s	1020 s	1290 s