

DYNAMIC ANALYSIS IN RISA

Debbie Penko, P.E.

OVERVIEW

- Finding Natural Frequency / Fundamental Period of a Structure
- Defining Dynamic Mass
- Response Spectra Analysis
- Troubleshooting your Model
- Preview of Time History (Coming Soon)

SOLVERS IN RISA

➤ Standard Solver

Sub-space iteration to solve for the Eigen values

➤ Accelerated Solver

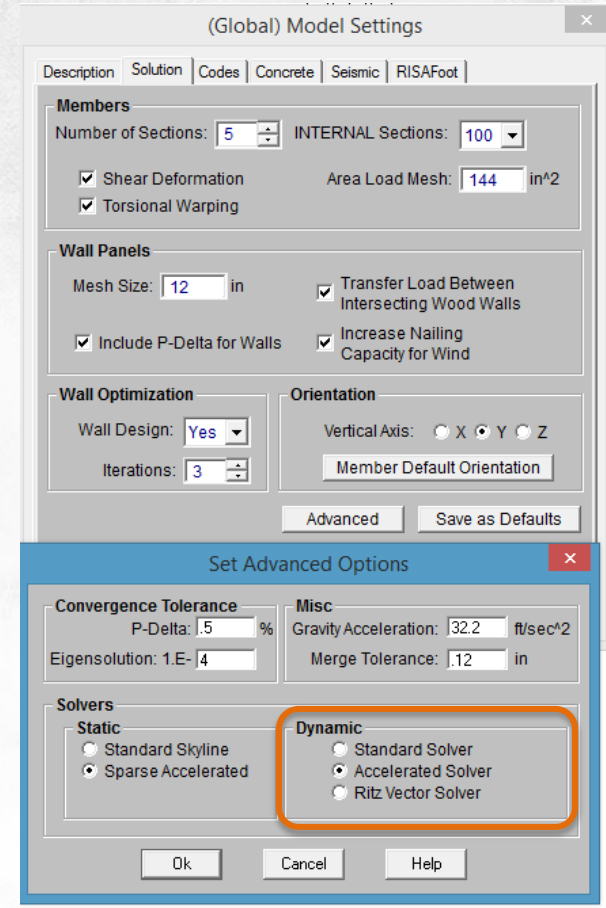
Direct Jakobian

Accelerated Sub-Space solver

Lanzcos Solver

➤ Ritz Vector Solver - **NEW**

Load Dependent Ritz (LDR) vectors



DYNAMIC ANALYSIS STEPS

1. Build structural model.
2. Model the mass/effective seismic weight.
(ASCE 7 Section 12.7.2)
3. Perform an Eigen solution and verify proper mass participation .
(ASCE 7 Section 12.9.1)
4. Perform a response spectra analysis (RSA).
5. Scale the RSA results down by both the ELF method and by I/R.
6. Run spectral response load combinations (instead of EL).
7. Design/analysis of members to these forces.

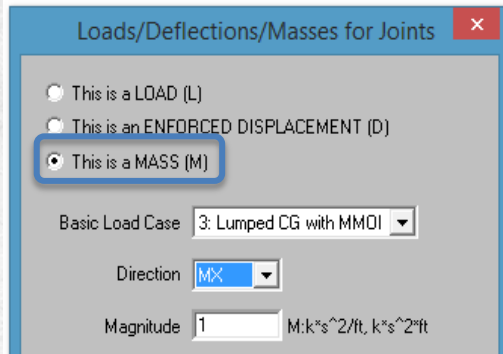
LOAD OR MASS?

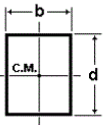
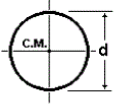
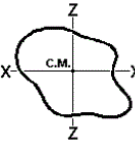
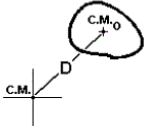
Load

- Vertical Loads → Mass (X, Y, Z)

Mass

- Lumped Mass (aka Discrete Mass)
- Mass Moment of Inertia (MMOI)



Area Plan View	Formula
	$M (b^2 + d^2) / 12$
	$M d^2 / 8$
	$M (I_{xx} + I_{zz}) / A$
	$MMI_0 + M D^2$

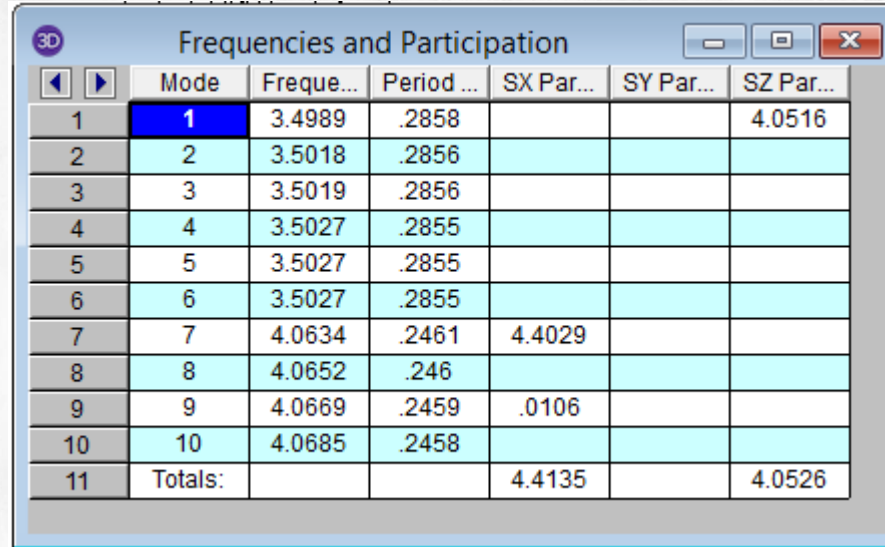
Let's see this in RISA-3D!

MASS PARTICIPATION

90% Participation Rule ASCE7 12.9.1

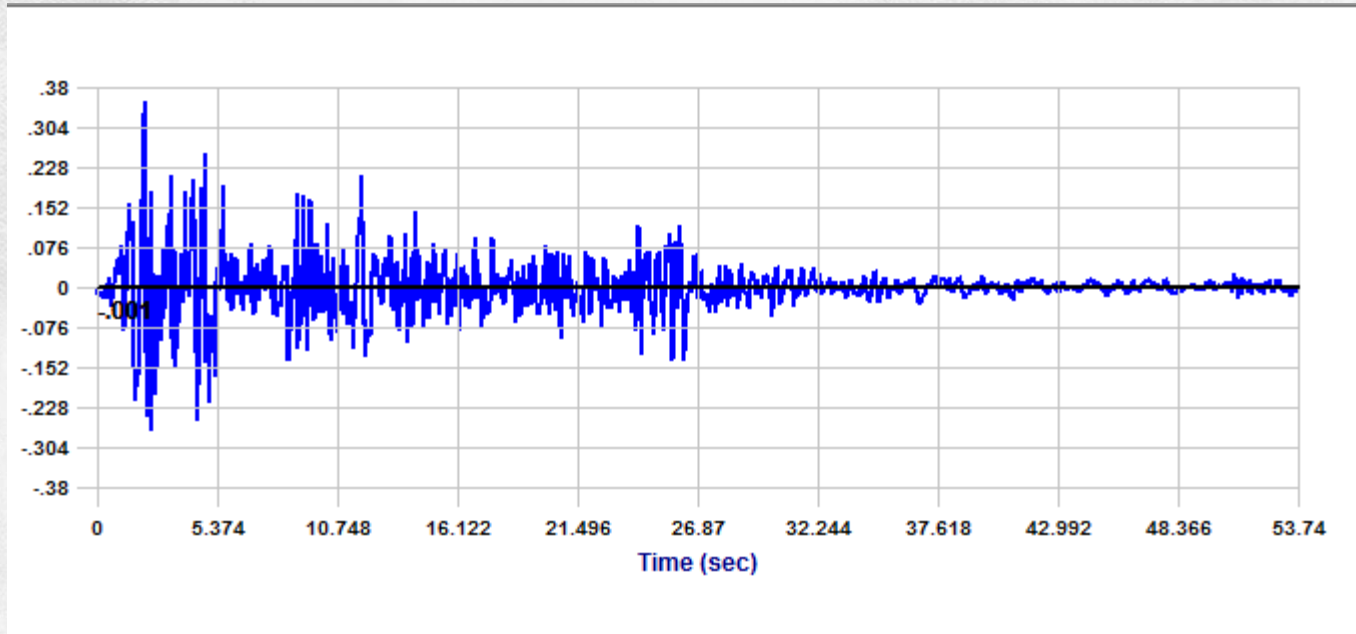
What to do?

1. More Modes
2. Discretizing the Mass
3. Add Accidental Torsion
4. Switch Solvers



	Mode	Freque...	Period ...	SX Par...	SY Par...	SZ Par...
1	1	3.4989	.2858			4.0516
2	2	3.5018	.2856			
3	3	3.5019	.2856			
4	4	3.5027	.2855			
5	5	3.5027	.2855			
6	6	3.5027	.2855			
7	7	4.0634	.2461	4.4029		
8	8	4.0652	.246			
9	9	4.0669	.2459	.0106		
10	10	4.0685	.2458			
11	Totals:			4.4135		4.0526

TIME HISTORY - COMING SOON!



QUESTIONS?

Please let us know if you have questions

- We will answer questions for the next 5 minutes
- Once the webinar is closed, we will post all Q&A's at [risa.com](https://www.risa.com)
- For further information, contact us at info@risa.com