

# Final Project

## Vibrations of Assembled Structures

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Prof. Gaël Chevallier

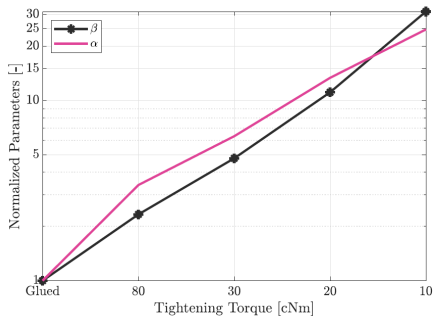
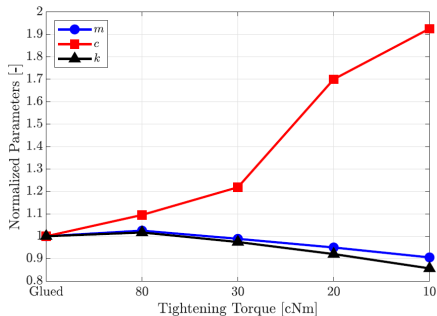
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# Defining Parameters



# Normalized Parameters



Configuration	$m[kg]$	$c[Ns/m]$	$k[10^7 N/m]$	$\beta[10^{11} Ns/m^3]$	$\alpha[10^{15} N/m^3]$
Glued	0.0917	2.7946	1.1204	1.4862	-2.0090
80 cNm	0.0945	3.0461	1.1428	3.4628	-6.8306
30 cNm	0.0908	3.4094	1.0868	7.0892	-12.6969
20 cNm	0.0871	4.7508	1.0308	16.4968	-26.8001
10 cNm	0.0834	5.3656	0.9635	46.1316	-49.8031

# Time Domain Simulation: Sweep-Sine



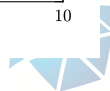
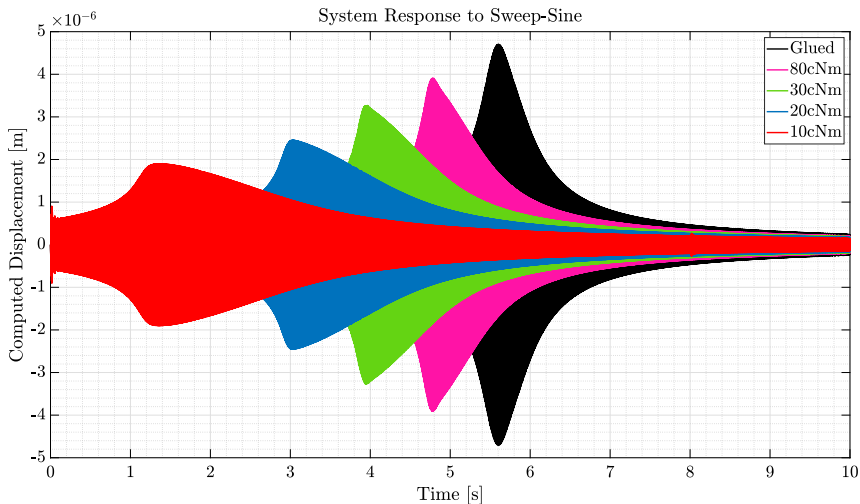
# Sweep-Sine Parameters

Time [s]	Min.Freq. [Hz]	Max.Freq. [Hz]	Force [mN]	Fs [Hz]
10	1680	1820	200	18200

- Processed on an Intel i7 (9th), GTX 1660, 16 Gb RAM;
- 1 hour to compute the 5 configurations via ODE45.



# System Response to Sweep-Sine



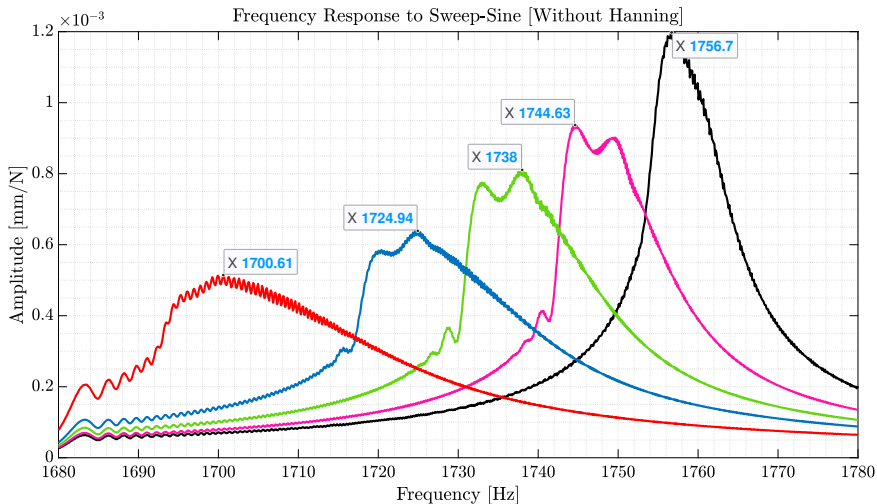
# System Response to Sweep-Sine

- Firstly, it was tried to compute the Frequency Response by “cutting” the 3D plot of TimeFreqPlot function;
- The frequency response presented just a few points, due to the small sample size ( $N_k = 256$ );
- Increasing this value does not improve significantly the frequency response;
- It was used FFT using zero-padding and windowing techniques to complete this task<sup>1</sup>.

<sup>1</sup><https://www.youtube.com/watch?v=XEbV7Wfo0SE>

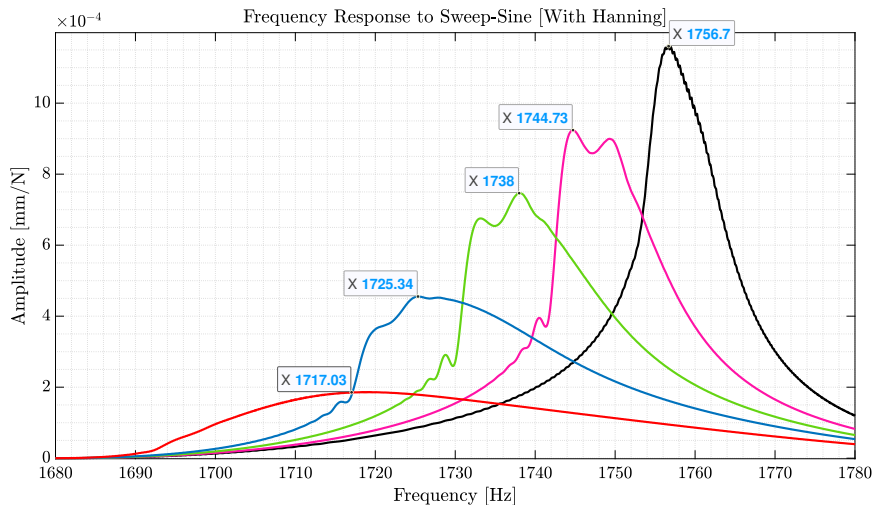


# System Response to Sweep-Sine





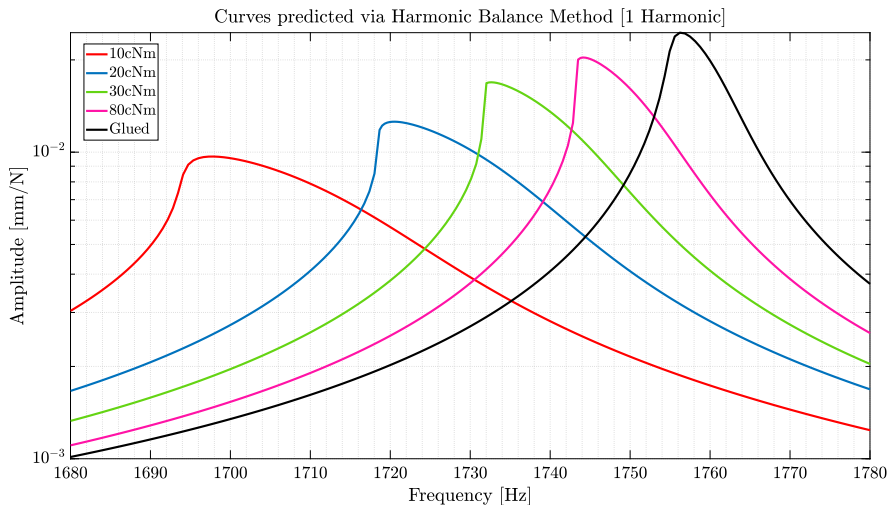
# System Response to Sweep-Sine



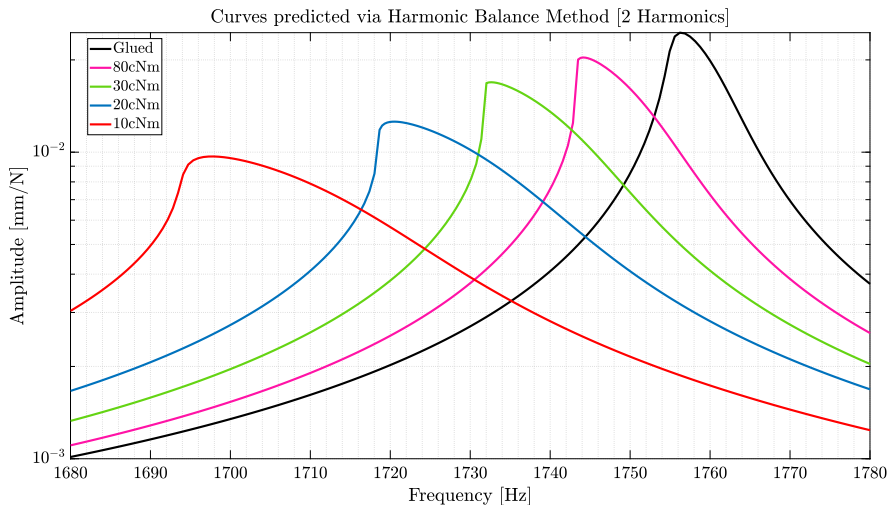
# Harmonic Balance Method



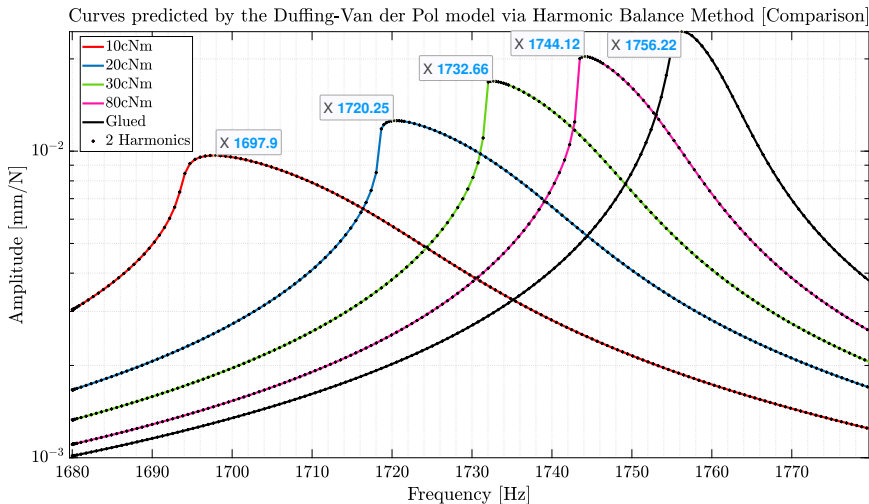
# Harmonic Balance - 1 Harmonic



# Harmonic Balance - 2 Harmonics



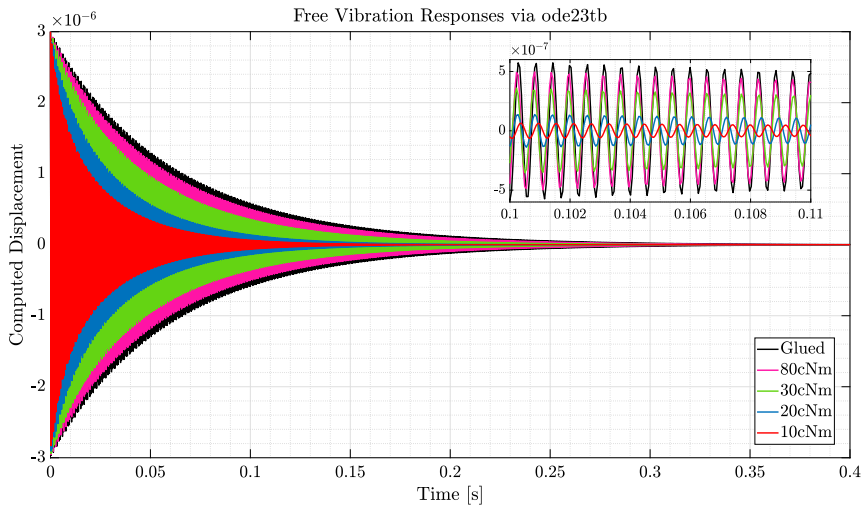
# Harmonic Balance - Comparison



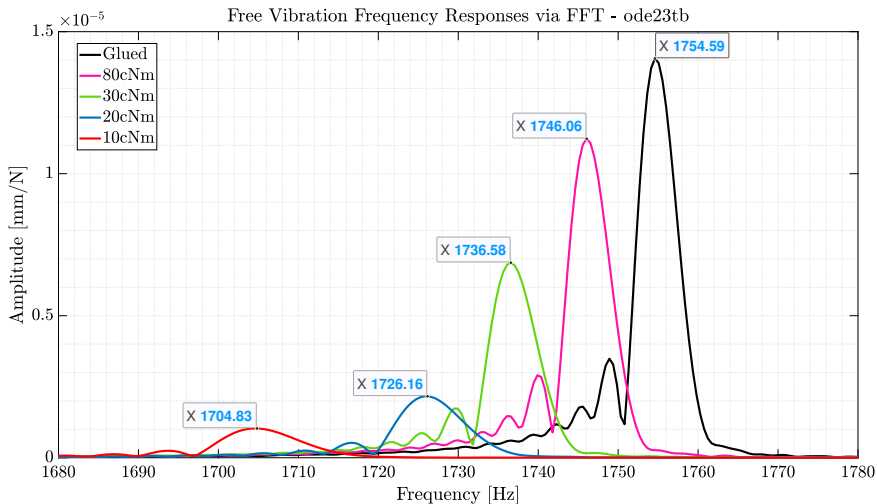
# Free Vibrations



# Free Vibrations



# Free Vibrations

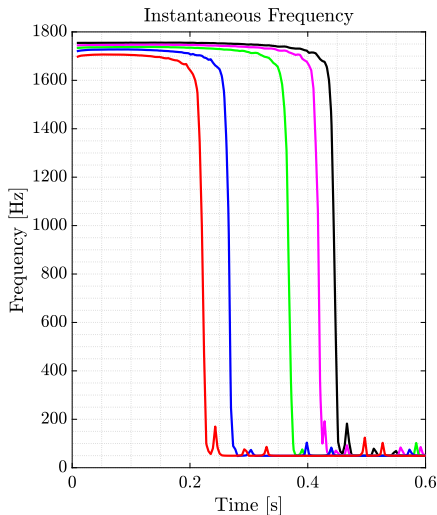
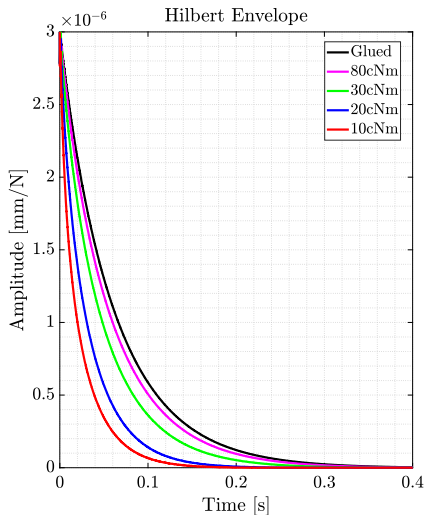




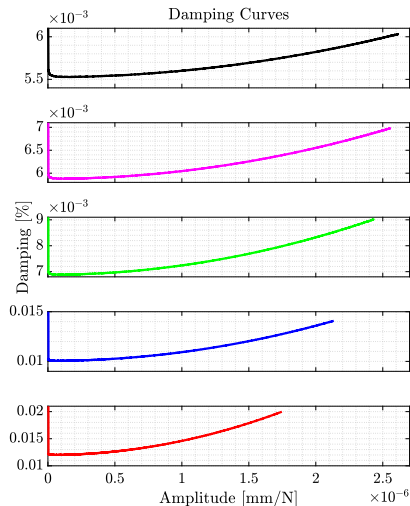
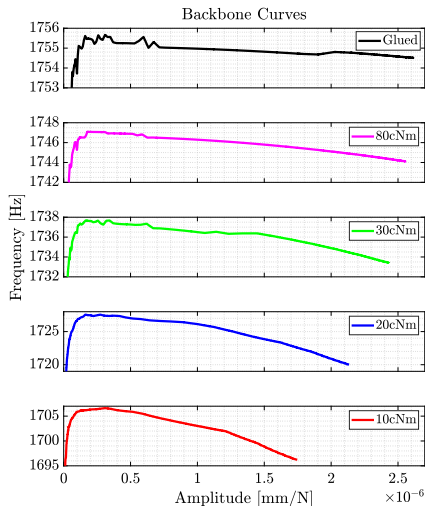
# Parameters Identification from Free Vibrations



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# Parameters Identification from Free Vibrations



# Acknowledgements

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# Thank you for your attention!



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