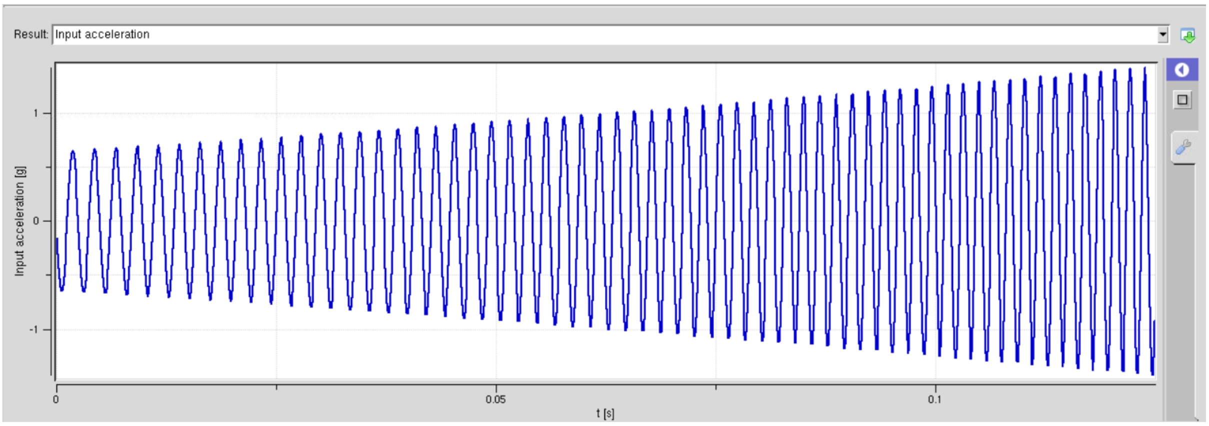
Piezoelectric for Energy Harvesting

TOOL OUTPUTS

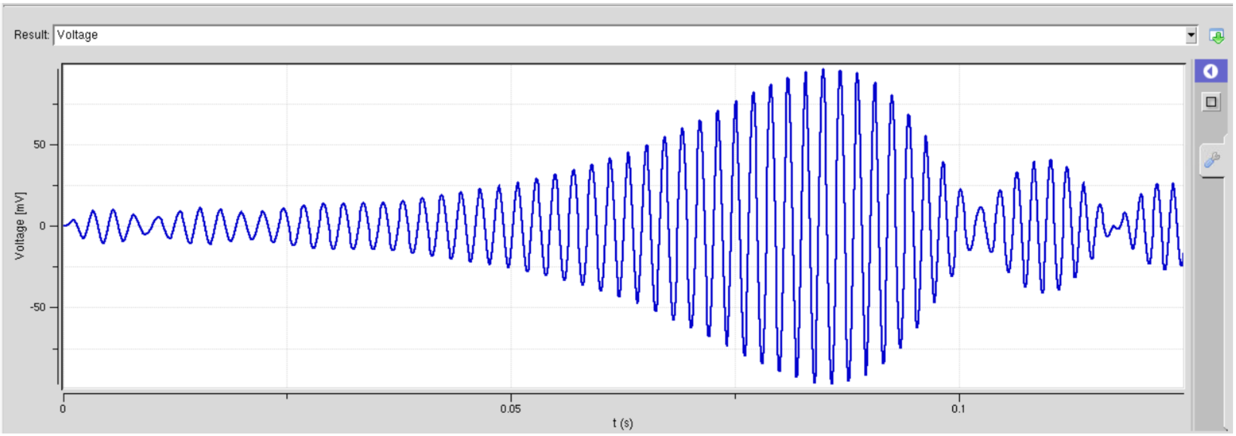
❖ Input Acceleration



Explanation:

Input Acceleration represents the acceleration experienced by the device due to external mechanical vibrations or movements. For example, if the bimorph piezoelectric beam is part of a sensor attached to a vibrating surface, the input acceleration would measure the acceleration of that surface. This acceleration induces mechanical deformation in the piezoelectric material, leading to the generation of electrical voltage.

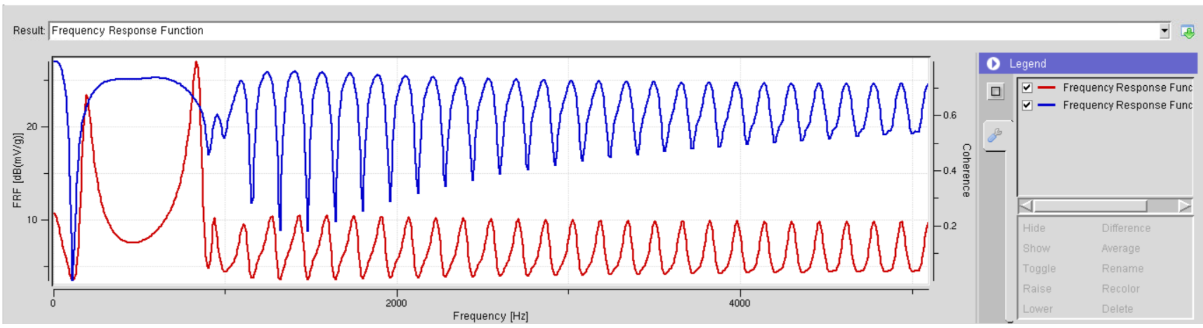
❖ Voltage



Explanation:

When a unimorph / bimorph piezoelectric beam is mechanically deformed (bent or subjected to vibrations), it induces a strain in the piezoelectric material. This strain results in a polarization of charges within the material, leading to the generation of an electrical voltage. The voltage generated is proportional to the applied mechanical stress or deformation.

❖ Frequency Response Function



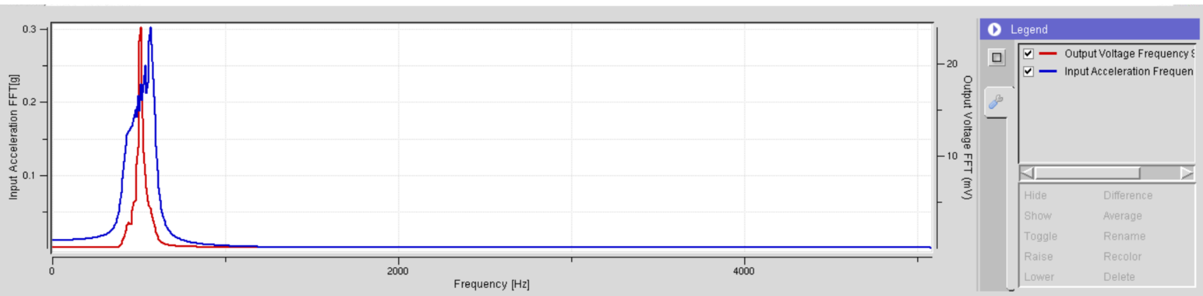
Explanation:

Peaks: These reveal the "sweet spots" where the harvester vibrates most readily and produces the highest voltage, called resonant frequencies. Think of them as the notes your harvester likes to play!

Shape: The overall smoothness indicates how readily the harvester responds to vibrations. A smooth curve means it readily captures energy across a range of frequencies, while a jagged curve suggests sensitivity to specific frequencies.

Coherence: This value tells you how reliable the data is. High coherence (close to 1) means the measurements are accurate, while low coherence suggests noise or other disturbances might be affecting the results.

❖ Input – Output FFT



Explanation:

FFT (Fast Fourier Transform): It's a mathematical technique that breaks down a signal into its constituent frequencies, revealing the strength of each frequency component.

Input-Output Relationship: The output shows how the input acceleration (in g) at different frequencies is transformed into output voltage (in mV) by your piezoelectric MEMS energy harvester.

Identifying Dominant Frequencies: Examine the output to see which frequencies in the input acceleration have the most significant influence on the output voltage. These are likely the resonant frequencies of the harvester.

Understanding Frequency Response: Observe how the output voltage varies across different frequencies to assess the harvester's sensitivity and bandwidth.

Input params of above graphs

BEAM	
Geometry	**Default**
Thickness of PIEZO	265 um
Thickness of Substrate	140 um
Length	24.53 mm
Length of proof mass	0.05mm
Width	6.4 mm
Gap	24mm
No. of piezo layers	2
Type of connection	Parallel
Mechanical Properties	**Default**
Proof of Mass	1 mg
End mass density	19000 kg/m3
Mode	DB
Piezo	PZT-5H
Substrate	Brass

VIBRATION	
Frequency Sweep	**Default**
Start	400 Hz
End	600 Hz
Start Amplitude	1 um
End Amplitude	1 um
Exponential Decay Constant	0
Random Vibrations	**Default**
Expected amplitude of a random vibration	none
Hammer Hit	**Default**
Energy per Impulse	none
No. of hits	none
Predetermined Vibrations	**Default**
Common vibrations like 5 hp machine tool, washing machine, dryer	none

OTHER PARAMETERS	
Environment	**Default**
Temperature	273K
Atmospheric Pressure	101000Pa
Circuit	**Default**
Type of Circuit	Resistive
Load (R)	7600Ohm
Load Capacitance	10^(-6) F
Threshold Voltage	None