Energy Dissipation in Conductive Polymeric Fiber Bundles: Simulation Effort

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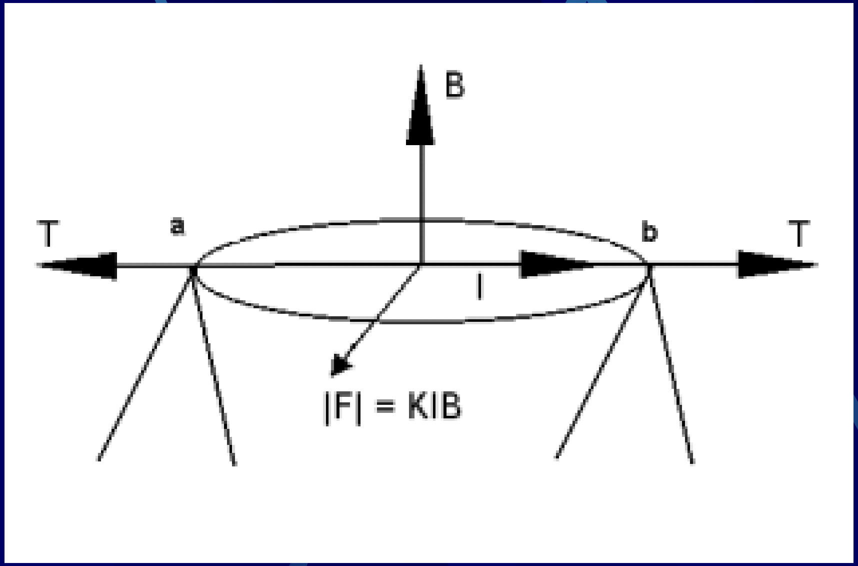
Experimental Scheme



B is the magnetic field.

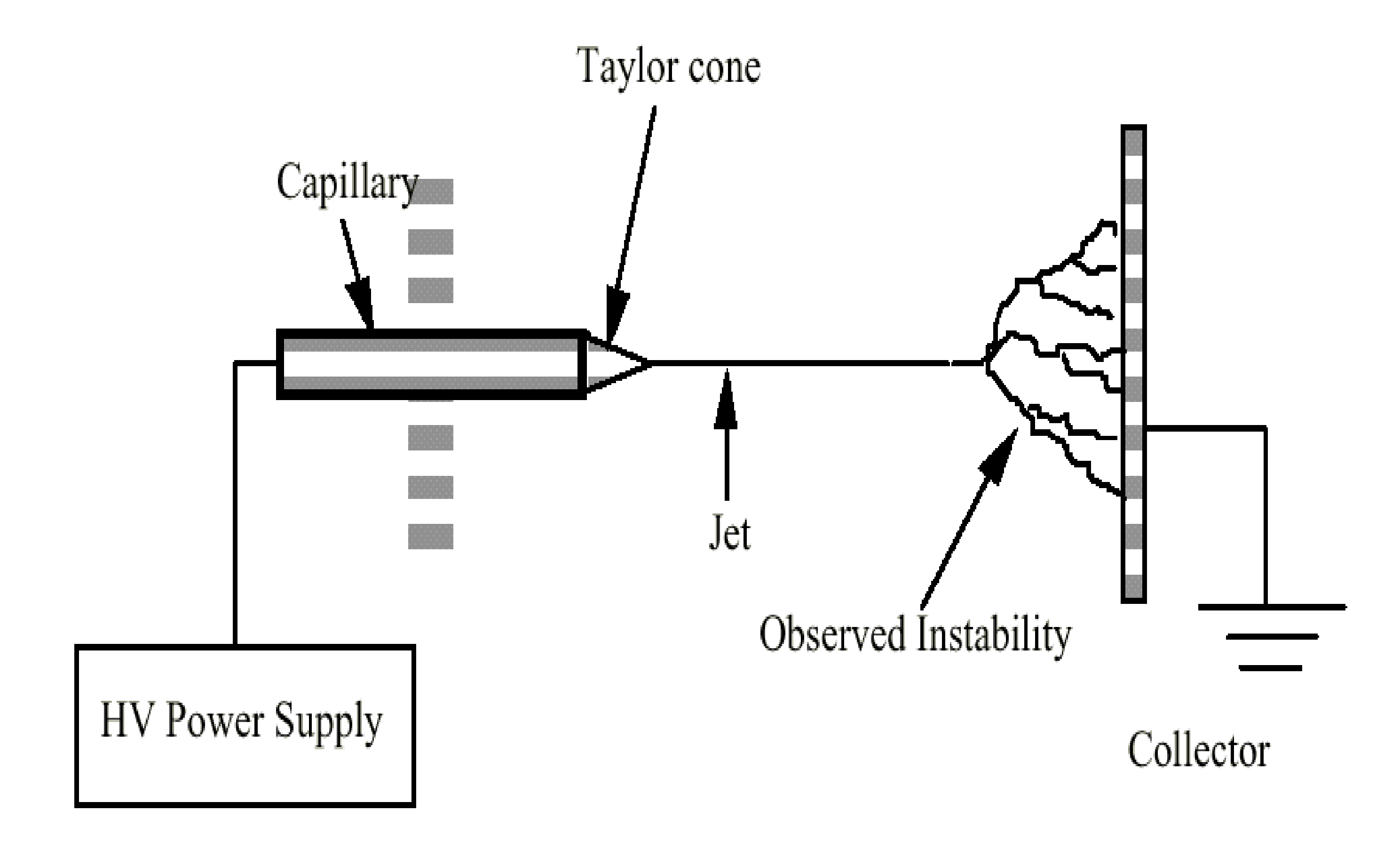
I is the current through the beam.

|F| is the resulting Lorentz force.

Outlines

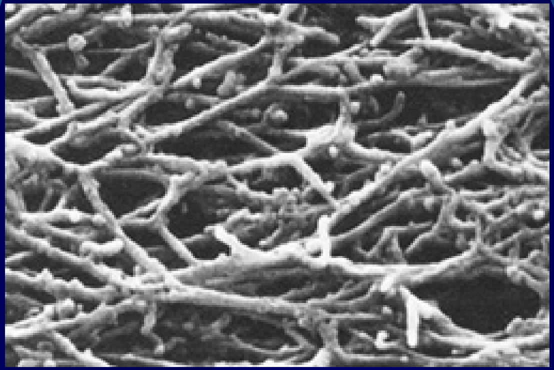
- Electrospinning
- Polymers
- Friction

Electrospinning



Polymers

Examples of conductive polymers



Friction

- Definition

a. For every stress there is a unique equilibrium value for strain, and vice versa.

b. The equilibrium response is achieved only after the passage of sufficient time.

c. The stress strain relationship is linear.

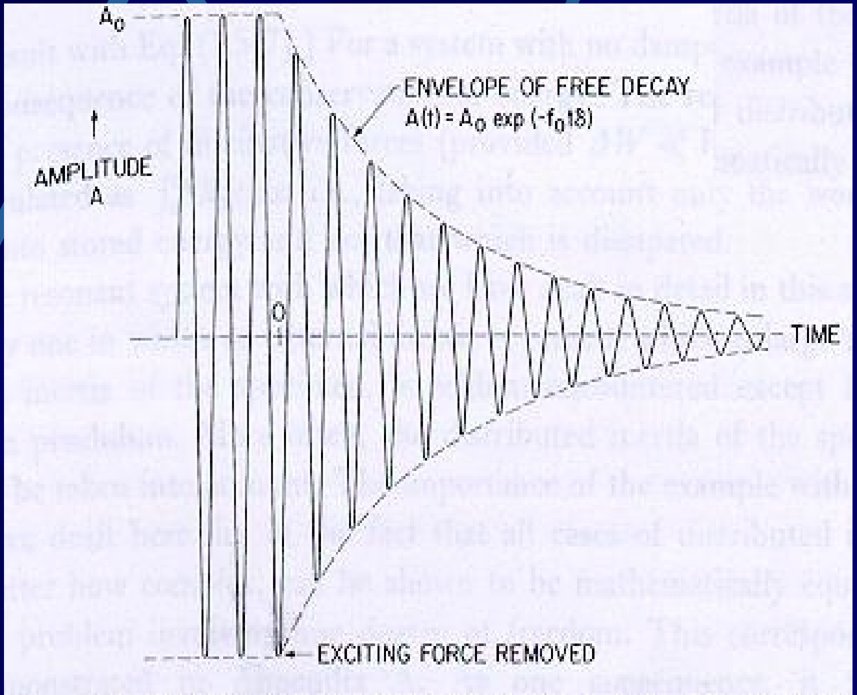


Fig. 1-8. The free decay of natural vibrations of an anelastic solid.

Mathematical Model

- Differential Equation

$$\frac{\partial^2 U}{\partial t^2} = C^2 \frac{\partial^2 U}{\partial x^2}; C = \sqrt{\frac{T}{P}}$$

- Initial Conditions

$$U(\omega,0) = f(x); \frac{\partial U}{\partial t}(x,0) = g(x)$$

- Boundary Conditions

$$U(0,t) = U(l,t) = 0$$

Differential Equation Solution

$$U(\omega) = \frac{F(\omega)/Keff}{\sqrt{\left(\omega^2 - \omega_0^2\right)^2 - \left(\frac{\omega * \omega_0}{Q}\right)^2}}$$

$F(\omega) = A * \cos(\omega t)$

Q = Quality Factor

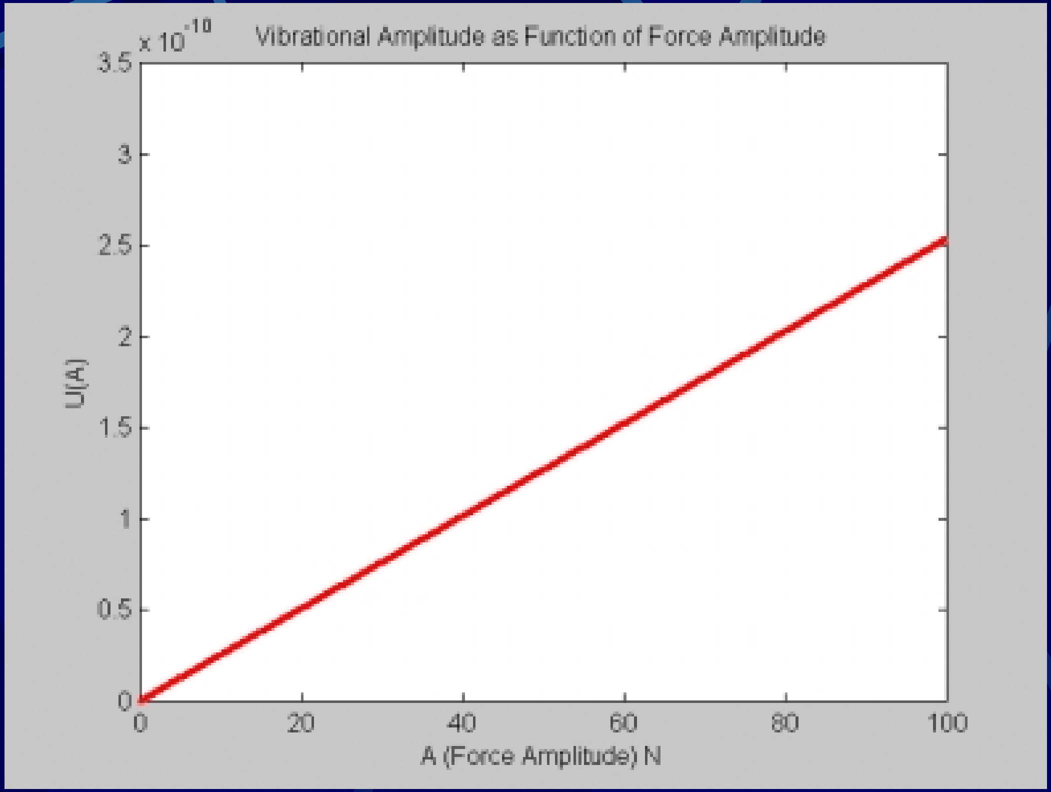
ω $= 2\pi f$

Constant values:

Initial frequency = 70 Hz

$Keff$ = Spring Constant = 1N/m

Results

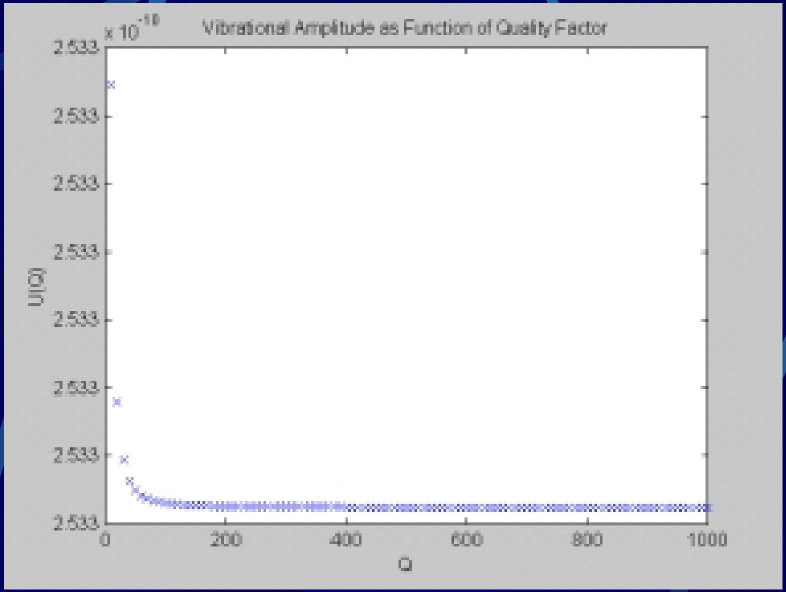


Quality Factor = 10^5

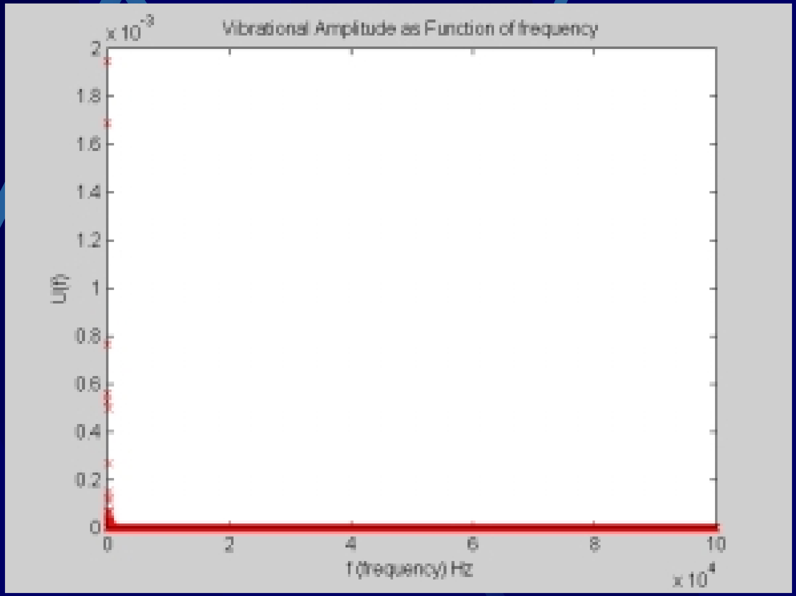
Frequency = 10^5 Hz

Force Amplitude = 0 N to 100 N in steps of 0.2 N

Vibrational Amplitude as dependent on Quality Factor and Frequency

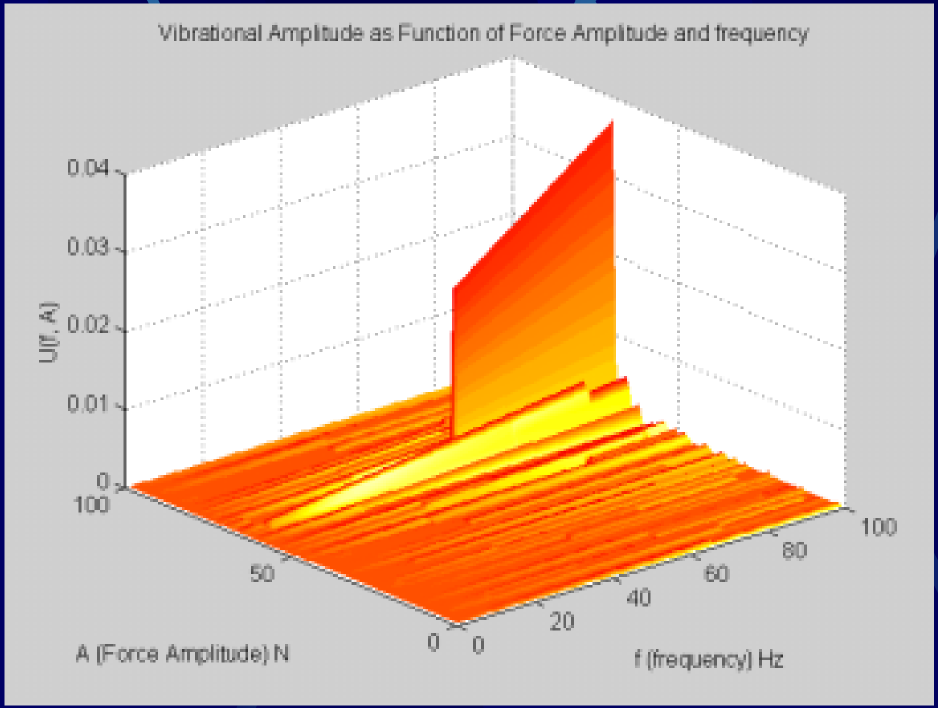


Force Amplitude = 0.1 N
Frequency = 10^5 Hz
Quality Factor = 0 to 100 in steps of 10 units.



Quality Factor = 10^5
Force Amplitude = 0.1 N
Frequency = 0 Hz to 1000 Hz in steps of 5 Hz

Vibrational Amplitude as dependent on frequency and Force Amplitude

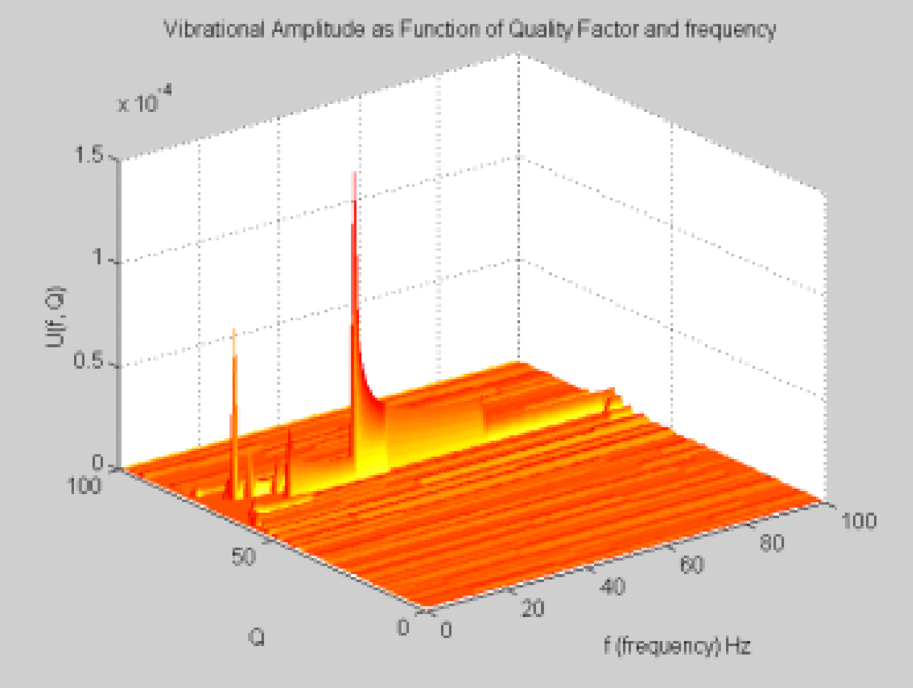


Quality Factor = 10^5

Force amplitude = 1 N to 100 N in steps of 1 N

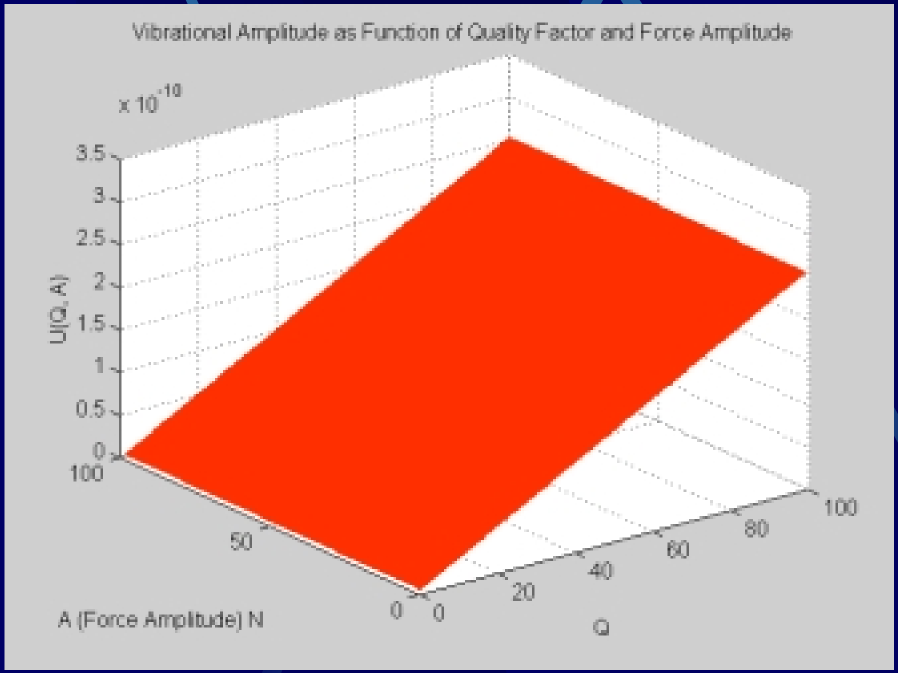
Frequency = 1Hz to 100 Hz in steps of 1 Hz

Vibrational amplitude as dependent on frequency and Quality Factor



Force Amplitude = 0.1 N
Frequency = 1 Hz to 100 Hz in steps of 0.5 Hz
Quality Factor = 1 to 100 in steps of 0.5 units

Vibrational amplitude as dependent on Quality Factor and Force Amplitude



Frequency = 10^5 Hz
Quality Factor = 1 to 100 in steps of 1 units
Force Amplitude = 1 N to 100 N in steps of 1 N

Conclusions

- Was developed a computational model that generate graphs about the functional dependence of the Vibrational Amplitude.
- The model was based in a equation that represents the Vibrational Amplitude of a double clamped beam as function on Force Amplitude, Quality Factor and frequency.
- For the case of Vibrational Amplitude as dependent on Force Amplitude, the model developed a graph that shows that the Vibrational Amplitude is proportional to the Force Amplitude.

Conclusions (cont.)

- For the cases of Vibrational Amplitude as dependent on frequency the model developed a graph that shows that the vibrational amplitude is higher when the system is driven at low frequencies.

Acknowledgment

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