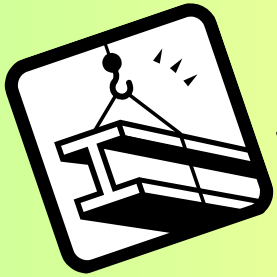
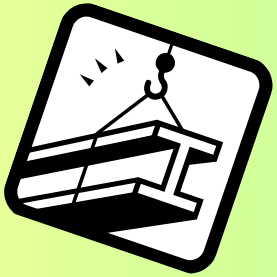


Vibrating Beam Data



The Confounding Variables

Group 5:

Alicia Israel, Terri Johnson, Jim Manning

Our First Model

- The Spring Model

$$Y(t,C,\omega,A) = Ae^{-1/2Ct}\cos(\omega t)$$

Initial Calculated Values:

A = max(response) = 6.8620×10^{-5}

C = 0.3856

$\omega = 12\pi$

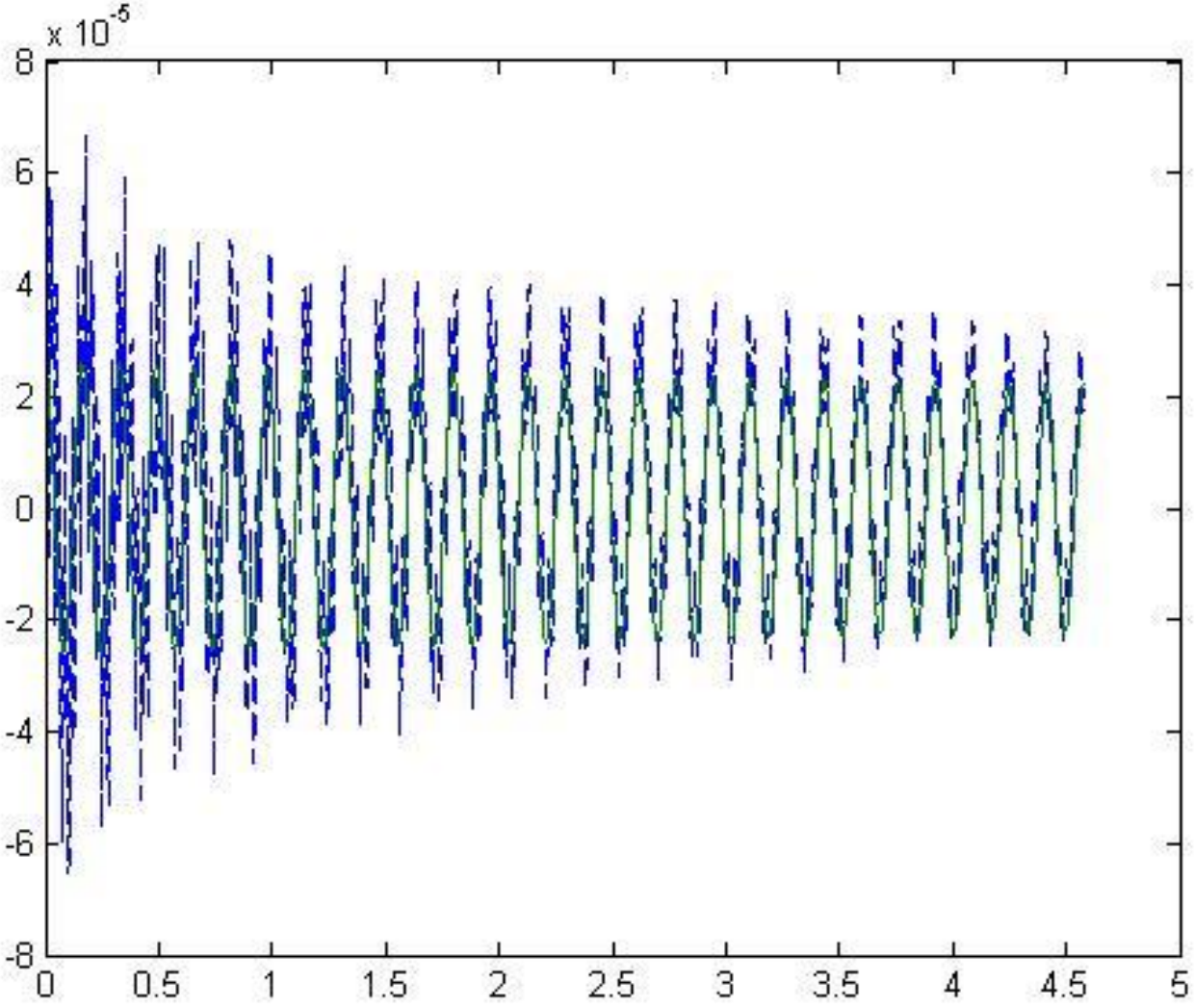
fminsearch values:

A = max(response) = 6.8620×10^{-5}

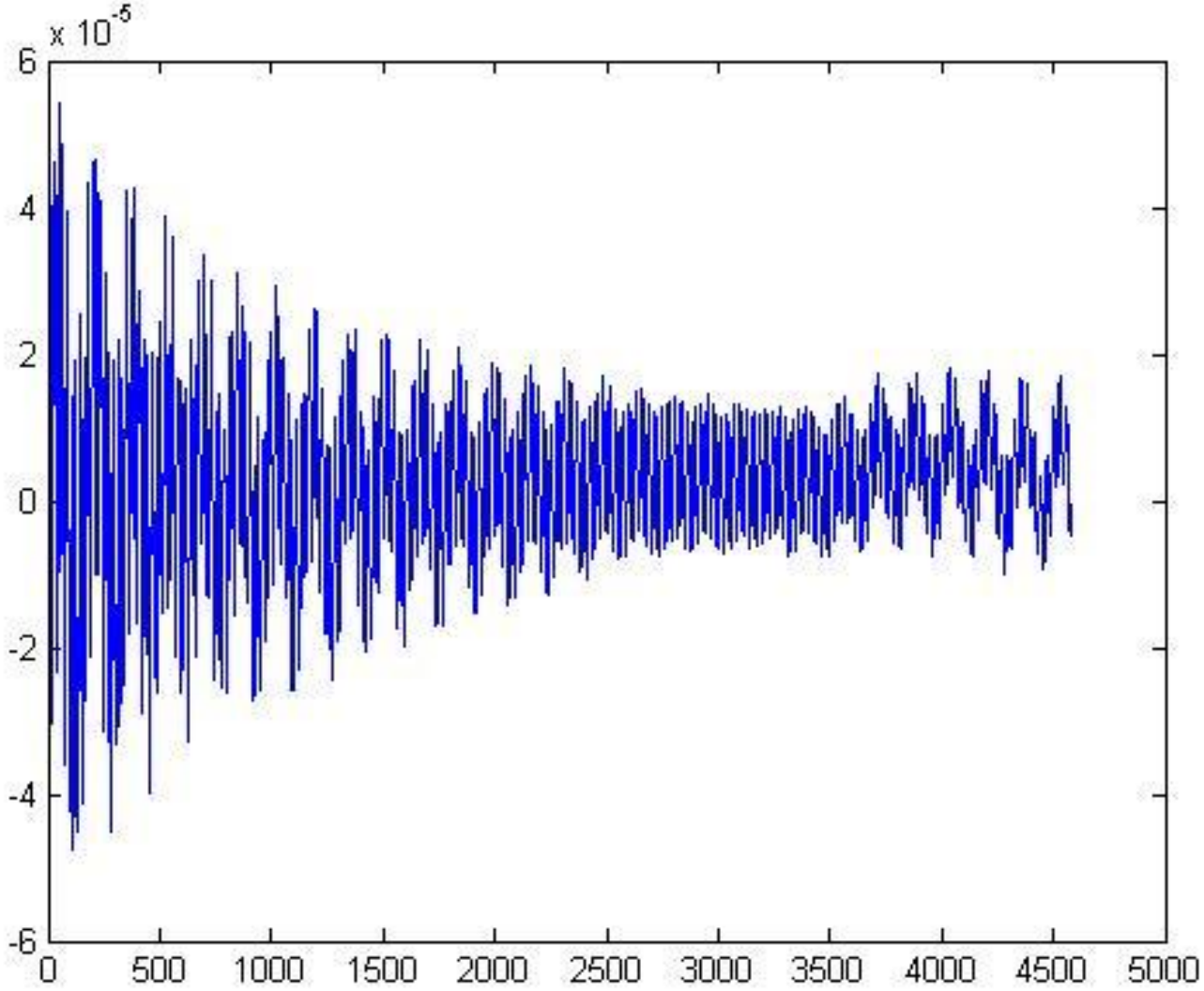
C = 0.3856

$\omega = 12\pi$

Spring Model



Residuals


x 10^-5
6
4
2
0
-2
-4
-6
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Our Second Model

- Alternative Beam Model and Optimization
  - More parameters

$$\int_0^\ell \rho \frac{\partial^2 w}{\partial t^2}\phi\,dx + \int_0^\ell \gamma \frac{\partial w}{\partial t}\phi\,dx + \int_0^\ell YI\frac{\partial^2 w}{\partial x^2}\frac{d^2\phi}{dx^2}\,dx + \int_0^\ell cI\frac{\partial^3 w}{\partial x^2 \partial t}\frac{d^2\phi}{dx^2}\,dx = \int_0^\ell f\phi\,dx$$

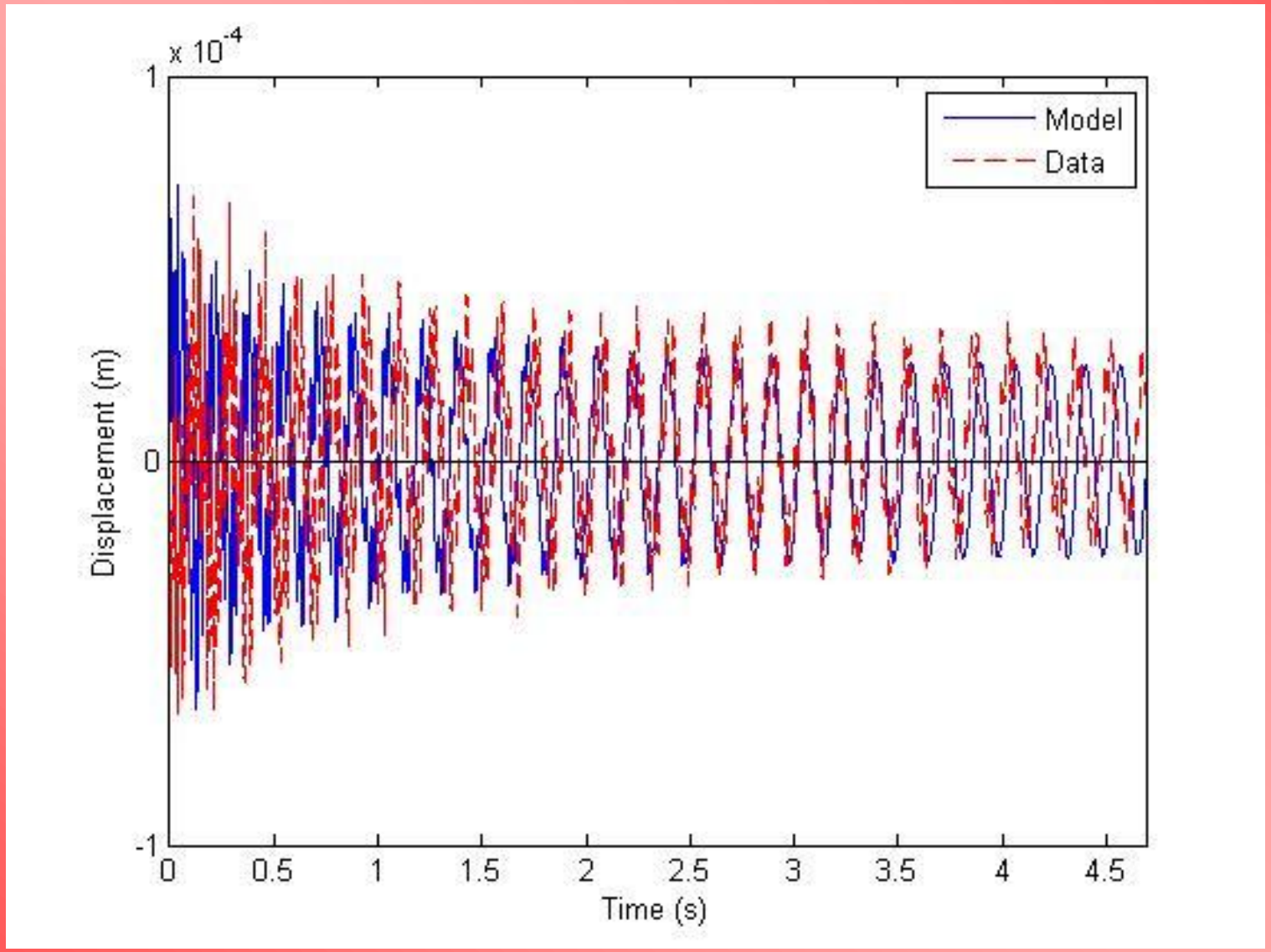
Initial Estimated Values:

q = [.1955, 7e-6, 1e-3, 2e-4, -.5, 1e-3,0]

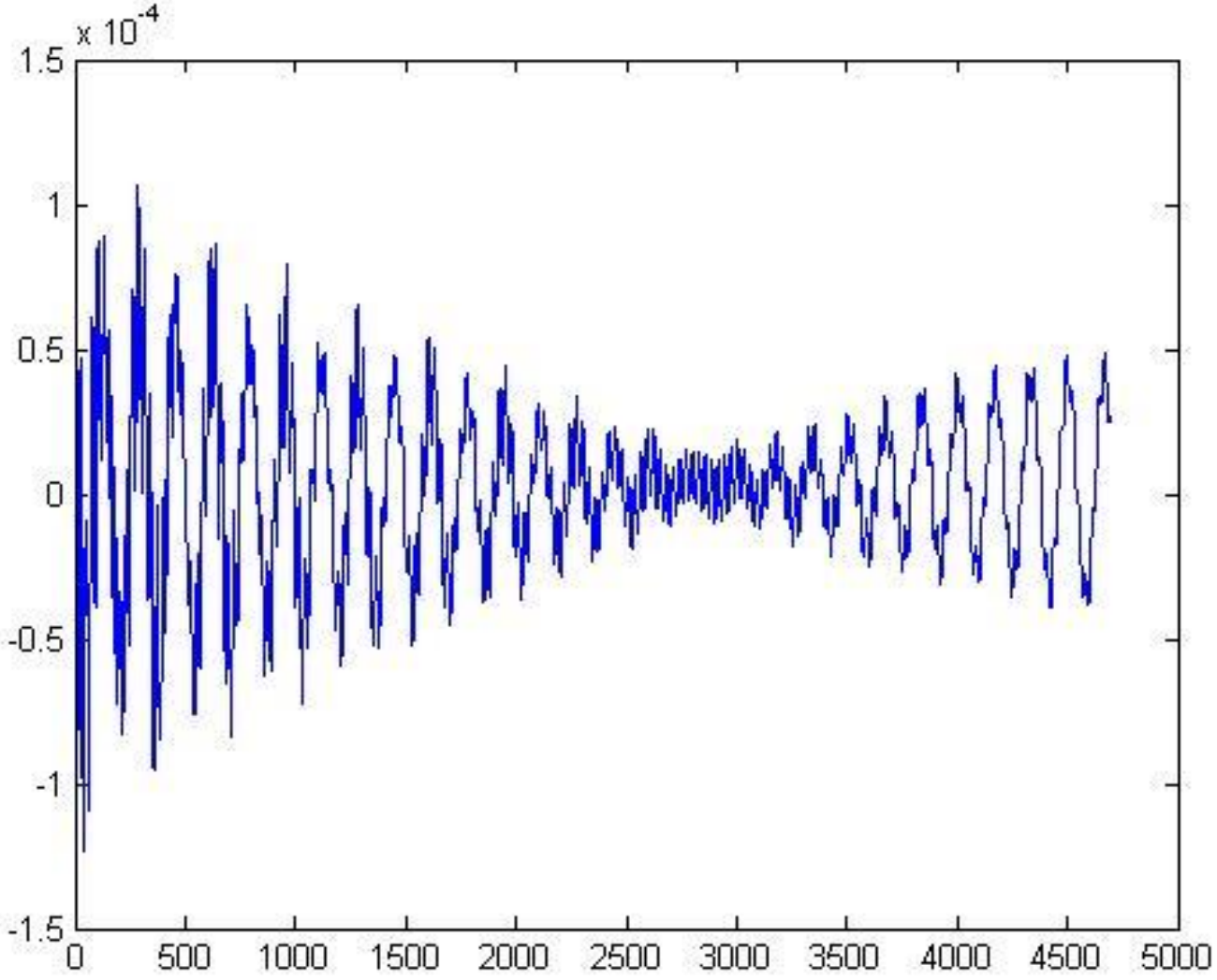
fminsearch Values:

q = [0.1038 , 5.2682e-6, 0.0014 , 0.0001, -0.3127 , 0.0010 , 0.0071]

Alternative Beam Model



Residuals


x 10^-4
1.5
1
0.5
0
-0.5
-1
-1.5
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

Conclusions

- Neither of our models fit perfectly
- A combination of our two would be ideal
- Good starting place for further analysis

THE END!