

# Traffic-induced Vibration TD-2

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- Records w1.mat, w2.mat, and w3.mat are available through the course website.
- These records each contain a vector  $\mathbf{w}$  of length  $m = 4096$ . The components  $w_1, w_2, w_3, \dots, w_m$  of  $\mathbf{w}$  are the values taken by the unevenness at a sequence of equally spaced points  $0, a, 2a, \dots, (m - 1)a$ , where the sampling interval is equal to  $a = 0.05$  m.

1. For each record, please complete the following steps:

- (a) Plot the unevenness as a function of the position.
- (b) Split the record into  $\nu = 8$  subrecords of equal length and transform each subrecord into the wavenumber domain by using the discrete Fourier transform. For one of the subrecords, plot the amplitude of the transformed unevenness as a function of the wavenumber, first on a linear scale and then on a loglog scale.
- (c) Estimate the power spectral density function. Plot this estimate as a function of the wavenumber, first on a linear scale and then on a loglog scale.
- (d) Consider the approximation of the power spectral density function using an expression of the form  $s_W(\xi) = s_0 / (1 + \frac{|\xi|}{\xi_0})^\alpha$ , in which  $\xi_0 = 0.5 \text{ m}^{-1}$ . For each record, use a linear regression on a loglog scale to deduce values for  $s_0$  and  $\alpha$  from the estimate you obtained under (c).

2. Interpret your results.