Introduction to Power Spectra

- This technique finds the frequency content of a signal
- For example, the vortex shedding frequency in the cylinder wake
- Common method is to average Fast Fourier Transforms of segments of the data
- The digital scope will do these live while you watch
- You can also do them afterwards
- Frequency resolution is 1/time period of FFT records
- Averaging more FFT's reduces noise in spectrum

Reminder re Digital Scope

- A digital oscilloscope takes an analog input signal and turns it into digital data.
- The input amplifiers can be set to DC coupling (the whole signal) or AC coupling (removing the `low' frequencies)
- The vertical offset control sets a voltage that is subtracted from the analog mean before digitization
- The settings of the volts/division sets the gain of the amplifiers, which sets the vertical resolution of the digitization
- The sampling frequency and record lengths set the horizontal resolution of the digitization. 'Setup Timebase' shows the current settings
- These settings need to be appropriate, as the 8-bit scopes are not all that forgiving. 8 bits is 256 counts of resolution.
- Don't sample the hot wire at 1MHz, it only puts out data to about 20-40kHz

Introduction to Power Spectra, 2

- Don’t alias! Need min. of 2 pts per wavelength, better to have 4 or 8
- More data reduces aliasing risk, improves frequency resolution and averaging
- Don’t (didn’t) need to focus on this in wake lab. Depends on your interests. However, you will need this in the water-tunnel lab to get velocity from the frequency of the doppler signal in the LDV setup.