# Procedure

Michael Raba

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# Outline

# Part 1. Spectral Analysis

- take fft azimuthally
  - use half of $\theta$ data to avoid aliasing
- find correlation in $t, t'$ described in Smits2017.below.eq.2.4.

$$\mathbf{R}\left(k; m; t, t'\right) = \int_r \mathbf{u}(k; m; r, t)\mathbf{u}^*\left(k; m; r, t'\right) r \, \mathrm{d}r \tag{1}$$

- take fft in $x$ of the above correlation to get $k$ modes.

# Part 2. Snapshot POD

- the crossspectra for the kernal of the pod

$$\lim_{\tau\to\infty}\frac{1}{\tau}\int_0^{\tau}\mathbf{R}\left(k;m;t,t'\right)\alpha^{(n)}\left(k;m;t'\right)\mathrm{d}t'=\lambda^{(n)}(k;m)\alpha^{(n)}(k;m;t)$$

- Find the (sorted) eigenvalues $\alpha^{(n)}$ found in (2) to solve for $\Phi^{(n)}$,

$$\lim_{\tau\to\infty}\frac{1}{\tau}\int_0^{\tau}\mathbf{u}_{\mathrm{T}}(k;m;r,t)\alpha^{(n)^*}(k;m;t)\mathrm{d}t=\Phi_{\mathrm{T}}^{(n)}(k;m;r)\lambda^{(n)}(k;m)$$