Practice about the 1D Gaussian Random Field

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The idea of this practice is to generate a 1D Gaussian Random Field following a given power spectrum. You will first generate various realizations from a same power spectrum. In a second time, you will use the same random realization (i.e same seed) for distinct power spectra and see the difference.

1 1 power spectra, 5 random realizations

- Create a 1D real space array in order to define your real space framework : between 0 and 10 with 10000 values.
- get the corresponding frequencies using np.fft.fftfreq() with the corresponding binning information (the keyword start with a "d", finish with a "d" and is just one letter.. :))
- Create a Power spectrum $P(k) = (k + \epsilon)^{-2}$ with $\epsilon = 0.1$
- Generate five random realizations of the Fourier coefficients δ_k
- Do the inverse Fourier transform of the 5 realizations
- Plot the 5 realizations.
- Are they different? Do they look generating from a similar random process?

2 * 3 power spectra, 1 random realizations (Posgrado only)

- Create a 1D real space array in order to define your real space framework : between 0 and 10 with 1000 values.
- get the corresponding frequencies using np.fft.fftfreq() with the corresponding binning information
- Create a Power spectrum $P_2(k) = (k + \epsilon)^{-2}$, $P_3(k) = (k + \epsilon)^{-3}$ and $P_4(k) = (k + \epsilon)^{-4}$ with $\epsilon = 0.001$
- Generate only one random realization you will use to generate the 3 series of the Fourier coefficients δ_k (following $P_2(k)$, $P_3(k)$ and $P_4(k)$)
- Do the inverse Fourier transform of the 3 realizations
- Plot the 3 realizations.
- What can you conclude?