In the name of God

Department of Physics
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NUMERICAL ANALYSIS COURSE

Exercise Set 14: MF-DFA

(Due Date: 1403/10/30)

1. Using the data sets (0.2.txt, 0.5.txt and 0.8.txt), do following tasks:
A: According to the DFA algorithm, compute the Hurst exponents.

B: Compute the Auto-Correlation function and compute the power spectrum of 0.5.txt and 0.8.txt sets. Now according to the relation between H and scaling exponents of correlation function and power spectrum, check the consistency between your results computed directly and those results estimated by scaling behavior based on Hurst exponents.
C: Compute $h(q)$ as a function of q for each set of data. Explain the multifractality nature of data.

D: For each data set, construct the $x(t) \to x'(t) = x(i) + 2\sin(3t) + 2\sin(50t)$ and then compute the scaling function as a function of s. Show the presence of cross-over.

E: Using SVD, try to remove trends and then apply DFA algorithm on the clean data and compare the $f(s)$ versus s for $q = 2$ for clean data and original data.

2. Use the sunspot.txt data and plot $f(s)$ versus s according DFA.

3. Use the sunspot.txt data, make a low-pass filtered data (keep only first 1000 Fourier coefficients and set the rest to zero) and then use inverse Fourier transform. Now apply the DFA on the clean data set and compare your result with the original data.

4. Using the sunspot.txt data, make a High-pass filtered data (set the first 1000 Fourier coefficients to zero and keep the rest coefficient) and then use inverse Fourier transform. Now apply the DFA on the clean data set and compare your result with the original data.

Good luck, Movahed