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Effect of nonlinear filters on detrended fluctuation analysis ZHI CHEN, KUN HU, Boston Univ, PEDRO CARPENA, PEDRO BERNAOLA-GALVAN, Universidad de Malaga, Spain, H. EUGENE STANLEY, PLAMEN CH. IVANOV, Boston Univ — We investigate how various linear and nonlinear transformations affect the scaling properties of a signal, using the detrended fluctuation analysis (DFA). Specifically, we study the effect of three types of transforms: linear, nonlinear polynomial and logarithmic filters. We compare the scaling properties of signals before and after the transform. We find that linear filters do not change the correlation properties, while the effect of nonlinear polynomial and logarithmic filters strongly depends on (a) the strength of correlations in the original signal, (b) the power of the polynomial filter and (c) the offset in the logarithmic filter. We further investigate the correlation properties of three analytic functions: exponential, logarithmic, and power-law. While these three functions have in general different correlation properties, we find that there is a broad range of variable values, common for all three functions, where they exhibit identical scaling behavior. We further note that the scaling behavior of a class of other functions can be reduced to these three typical cases. We systematically test the performance of the DFA method in accurately estimating long-range power-law correlations in the output signals for different parameter values in the three types of filters, and the three analytic functions we consider.

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