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Continuing Inquiries Into R/S–like Dynamic Scaling Measures

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Abstract

Fusion research, like most scientific pursuits, generates streams of data from experiments and numerical simulations. Information is extracted from the numbers, in order to characterize the data set and gain insight into the source, as well as comparing the results from different sources. Statistical moments describe the distribution of a set, and dynamical measures (power spectra, correlations, etc.) describe particular features in the ordering of a series. Studies of chaotic and complex systems have led to many measures of scaling and self–similarity, including the Hurst exponent[1].

The Hurst exponent is a measure of correlations in a data series – correlations which may occur on all time scales. Rescaled range (R/S) analysis is the original method for finding the Hurst exponent, and this poster further investigates the dynamical information contained in this analysis. Many algorithms to produce fractional Gaussian noise (fGn – correlated data with a Gaussian distribution) have been developed; the construction of correlated data with an arbitrary distribution is examined. Also, artificial data sets have been designed to have other specific characteristics, such as multiple Hurst exponent regimes. Finally, there is a continuing effort to distill additional dynamical information with new R/S–like analyses, and the fruits of these efforts are also presented herein. The hope is that the dynamical properties of a data set can be more/completely described by hierarchy of Hurst–like measures.

[1] H. E. Hurst, Trans. Am. Soc. Civ. Eng. **116**, 770 (1951).