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Letter to the Editor

# Authors' response to letter of Prof. J. Drahos

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### On the general comments

- It is true that the paper of Drahos, Bradka, and Puncochar (1992) and our paper have a lot of features in common. Both papers address the application of fractional Brownian motion to pressure signals. But there are quite some differences to point out in both papers, our paper clearly states in paragraph 2 on p. 707 the working of the air-lift reactor consisting of a riser and a downcomer. Maybe it would have been better clarified by a schematic drawing of the air-lift reactor to show the recycling of the liquid phase. Therefore, it is quite astonishing that the same conclusions can be done about the air-lift reactor as for the bubble column. The other point is that our objective of applying the fractional Gaussian noise or Brownian motion is different. It is wanted to use the model to predict future values of the pressure signal and thereafter use the model for process monitoring or control while the other papers are concerned in distinguishing between hydrodynamic regimes. The discussion between the fractional Gaussian noise and the fractional Brownian motion is to exemplify clearly the differences between those two, as this might not be that clear to everybody.
- Prof. Drahos gives us too much credit in presuming that pioneering work is done in our paper. It is stated that Mandelbrot and van Ness (1968) and Hurst (1951) were the people who did pioneering work in model development and in analysis technique respectively and thus are cited. Our paper and others can thus be seen as an application of these tools. Furthermore it was cited in the introduction a recent paper by Camarasa et al. (2001), which addresses the determination of flow regimes in his model development including the fractional analysis. It was found convenient to cite a paper presented at the same congress. Of course it could have been cited any other paper to acknowledge the fact that it is known that we are not the first one to apply these techniques to pressure signals. In view of the first point and the similarity of the papers it can only be regretted afterwards for not citing the paper of Prof. Drahos.

### On the formal objectives

- The quantity of $\Delta t$ is time difference and can be interchanged with $\tau$, because $B_H(\Delta t) = B_H(t+\tau) - B_H(\tau) = R(\tau) \rightarrow R(\tau)/S \propto \tau^H = \Delta t^H$ (Feder, 1988, p. 178).

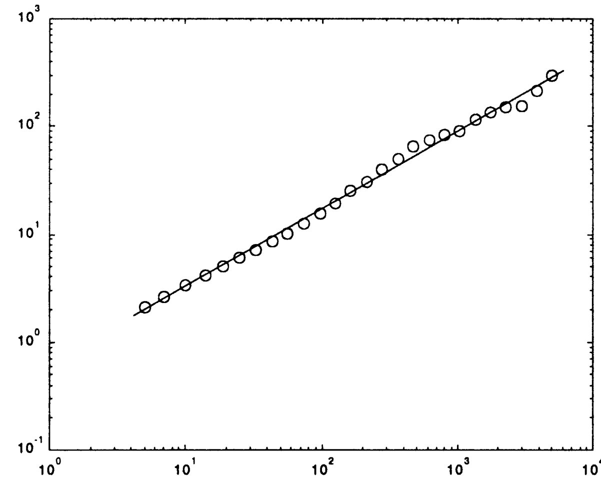


Fig. 1. Fractal analysis with the R/S-statistic of the pressure signal for an airflow of 3000 nl/h.

- The summation has to be done indeed to $t$ and not to $\tau$.
- Values of $H$ with four places might be said exaggerated still it does not effect the conclusions to be made.
- It is better to show why the deviation is higher at higher air flows by the figures as it seems to be a trend deviation (Fig. 1 & 2). It can be seen that at high airflows and low time lags there is a substantial deviation from the curve. Depending on which points are taken for the estimation of the Hurst parameter a different value is obtained. It was encountered in the paper of Drahos et al. the same deviation and it would be an interesting discussion what is the reason behind this. An argument can be that on short time scale a high dependence is obtained due to whirls in a turbulent flow, on a large time scale this results in a more average or well mixed behaviour.
- To compare the figures it is not necessary to put the description of the axes, also because we are not allowed to mention the real values. The simulations are to exemplify and not to collide one another, only the last figure where

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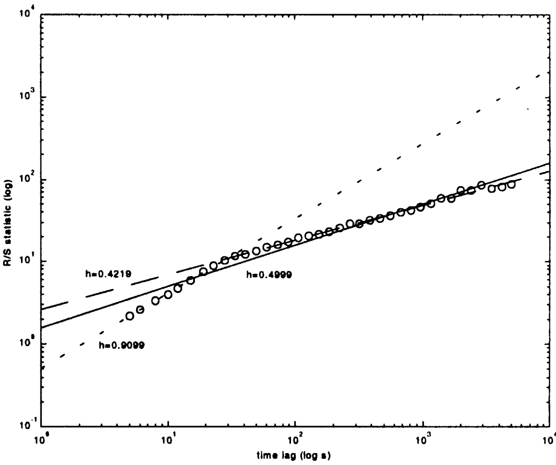


Fig. 2. Determination of Hurst parameter with the R/S-statistic for the pressure signal with an airflow of 20, 000 nl/h.

a prediction is made, it is to compare measured with prediction.

M. Filho
*Faculty of Chemical Engineering*
*State University of Campinas (UNICAMP)*
*Cidade Universitaria Zeferina Vaz, CP 6066*
*13081-970 Campinas, SP, Brazil*

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