LETTERS TO THE EDITOR

COMMENT ON "APPLICATION OF INFORMATION DIVERGENCE TO NUCLEAR REACTOR NOISE ANALYSIS"

In a recent article, Nagashima and Andrews[1] introduced the concept of information divergence, based on Kullback's information measure, into reactor noise analysis. I wished to call the attention of the authors to an article about the same subject published ten years ago.[2] Instead of using the word "Kullback's information measure," we called it "mutual information," which means practically the same. We also introduced the concepts of prevarication or noise entropy, negentropy, and equivocation.

For instance, the direct measurement of the frequency dependence of the mutual information by means of a two-detector cross-correlation measurement in a fast reactor system allowed to determine the reactivity states of various subcritical reactor configurations. In this context the "rate of information" in terms of bits per second and the polarity correlation method played an important role.

I want to stress the fact that substantial theoretical as well as experimental work in this field has been done. This seems to be unknown to the authors of Ref. 1.

In conclusion, it seems to me that the frequency domain—rather than the time domain as proposed by the authors of Ref. 1—is better suited for experimentally obtaining the "information" in reactor noise measurements.

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REPLY TO "COMMENT ON 'APPLICATION OF INFORMATION DIVERGENCE TO NUCLEAR REACTOR NOISE ANALYSIS' "

We regret that two ocean crossings have delayed our response to the Letter of Seifritz.[1] We welcome the opportunity of recognizing the important contributions of Seifritz and his co-workers in this area.[2,3] We also wish to pay tribute to the work of Kullback.[4] Although Albrecht and Seifritz[2] did not mention Kullback in their paper, we presume they would join us in recognizing his contribution.

In a field abounding in integral forms, there are sure to be significant similarities and differences. We were particularly impressed with the way in which Albrecht and Seifritz defined and used information entropy. On our part, we have stressed, *inter alia*, the total difference of two noise processes, using the concept of "distance." We believe our work has done something toward providing a firm theoretical foundation for extension of information theory developments from statistical processes to stochastic processes.

We do not support the opinion of Seifritz relating to concentration of work in the frequency domain to the exclusion of work in the time domain. We are, of course, aware of a significant amount of theoretical and experimental work in reactor noise that has been concentrated in the frequency domain. However, even with the substantial support provided by this significant resource base, reactor noise analysis has not been accepted on a scale commensurate with the benefits perceived by its proponents. Analysis has been concentrated in the frequency domain, with only limited auto- and cross-correlation functions in the time domain, whereas nuclear reactor operators are working in, and are familiar with, the time domain. Therefore, we considered that our original reactor analysis in the time domain would provide the beginnings of a fresh new approach that would receive the long-sought acceptance by nuclear utility operators.

We regret we overlooked a typographical error in our paper. In our Eq. (7), $\boldsymbol{f}_1 - \boldsymbol{f}_2$ should be in brace brackets.

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3. W. SEIFRITZ and D. STEGEMANN, *At. Energy Rev.*, **9**, *1*, 129 (1973).

4. S. KULLBACK, *Information Theory and Statistics*, John Wiley & Sons, Inc., New York (1959).