Letters to the Editor

On the Cross-Spectral-Density Sink Frequency Behavior in Coupled Core Reactors

In a Technical Note by Nagy and Danofsky[1] in this issue of the journal, the sensitivity of the sink frequency to core spacing and the thermal-absorption and fast-removal cross sections of the coupling medium of a two-slab coupled core reactor has been theoretically investigated. It was found there that for a 60-cm-wide heavy-water coupling region the sink frequency was predicted to occur at the very low angular frequency of 15 rad/sec.

However, two-detector cross correlation measurements at the Forschungs- und Meβreaktor Braunschweig (FMRB) which are being carried out presently cannot confirm this result. The FMRB is a swimming pool type reactor with two weakly coupled cores which are moderated and reflected by light water. Each core contains a 4 × 7 loading of MTR fuel elements with 90% ^{235}U enriched uranium. The coupling region consists of a 60-cm-wide heavy water tank. The quality of the heavy water is better than 99.75%. The aluminum walls of the tank are 8-mm-thick and there is a 6-mm-thick light water layer between each core and the side of the heavy water tank.

First evaluations of cross power spectral density measurements with the reactor at delayed critical and at a symmetrical power distribution lead to a sink frequency of about 250 rad/sec which is in poor agreement with the predicted theoretical value of Nagy and Danofsky.

The effect of the thin layer of light water on the theoretically predicted sink frequency has also been considered by us. Two contributions responsible for a change of the sink frequency were taken into account: The effects of the fast-removal and the thermal-absorption cross sections of the additional layer of light water which cause an increase and a decrease of the sink frequency, respectively. The overall effect has been estimated–by using the curves calculated by Nagy and Danofsky of the sensitivities due to these influences–to be smaller than one percent.

In conclusion, we agree with the general trends of the sink frequency with regard to the geometrical and material data of the coupling medium but the predicted numerical value of the sink frequency for a 60-cm-wide D_2O coupling medium could not be experimentally realized by us.

Furthermore, the characteristic time constant of the delay time distribution between the cores and the coupling reactivity have been determined for the FMRB according to the model of Albrecht and Seifritz[2,3] to be about 2 msec and 55 cents, respectively.

E. Viehl

Physikalisch-Technische Bundesanstalt
33 Braunschweig
Federal Republic of Germany

W. Seifritz

Institut für Kerntechnik
Technische Universität Hannover
3 Hannover
Federal Republic of Germany

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[1]M. E. NAGY and R. A. DANOFSKY, *Nucl. Sci. Eng.*, **42**, 419 (1970).
[2]R. W. ALBRECHT and W. SEIFRITZ, *Nukleonik*, **11**, 143 (1968).
[3]W. SEIFRITZ and R. W. ALBRECHT, *Nukleonik*, **11**, 149 (1968).

Additional Comments on the Cross-Spectral-Density Sink Frequency Behavior for Coupled Core Argonaut Reactors

The sink frequency as measured in the FMRB reactor by Viehl and Seifritz has been compared in the preceding Letter[1] with that calculated by Nagy and Danofsky[2] using a one-dimensional model of an Argonaut-type reactor. It is reported that the observed sink frequency is higher than that predicted for a 60-cm-thick D_2O coupling region.

It should be noted that the results shown as Fig. 3 in Ref. 2 represent a draftsman's fit to the calculated values given in Table I of this Letter. A calculated value for a 60-cm-thick D_2O model was not obtained in the original study and thus the value for the 60-cm coupling region is estimated from Fig. 3. Based on Fig. 3, the predicted sink frequency is approximately 40 rad/sec. This is less than the observed 250 rad/sec.

TABLE I

Sink Frequency as a Function of D_2O Coupling Region Size

Coupling Region Size (cm)	Sink Frequency (rad/sec)
20	5000
25	1600
35	560
45	260
55	110
75	0.17

The difference between the observed and predicted sink frequency may be due in part to the one-dimensional nature of the model used and in part to the two-energy group approximation used with the associated choice of nuclear constants. Also, the model used in the study of Ref. 2 had external graphite reflectors and 15-cm fuel regions and it is not known if variations in these properties might alter the predicted sink frequency.

R. A. Danofsky

Department of Nuclear Engineering and Engineering Research Institute
Iowa State University of Science and Technology
Ames, Iowa 50010

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[1]E. VIEHL and W. SEIFRITZ, *Nucl. Sci. Eng.*, **42**, 430 (1970).
[2]M. E. NAGY and R. A. DANOFSKY, *Nucl. Sci. Eng.*, **42**, 419 (1970).