Comments on "Numerical Calculations of the Global and Local Components of the Neutron Noise Field in Boiling Water Reactors"

In the following, we intend to comment on the evaluation of the cross power spectral density (CPSD) of the void fraction in boiling water reactors (BWRs), discussed in Sec. II.A of Ref. 1.

The authors have incorporated the probability of survival of bubbles (in the transit time between two points along the core height of the reactor) into the derivation of CPSD of void fraction and hence the model applies to both subcooled and bulk boiling regions. However, the authors seem to suggest that the auto power spectral density (APSD) of $\delta\alpha$ can be calculated by using the relation

$$\langle|\delta\alpha(z,i\omega)|^2\rangle = \frac{V}{A}\,\frac{\alpha(z)}{v(z)} \tag{1}$$

as derived by Kosaly et al.[2] In this connection, we would like to point out that Eq. (1) is valid only if one assumes that the basic noise source in BWRs is completely uncorrelated in space[3,4] and there are no flow fluctuations in the reactor core due to boiling noise. Further, the basic noise source is also assumed to be white in frequency. However, the studies reported in Ref. 4 clearly indicate that the source of noise in BWRs is neither white nor completely uncorrelated in space and that boiling noise in BWRs does affect the flow fluctuations in the reactor core (Ref. 5).

Under the assumption of completely uncorrelated noise in space and considering the effect of boiling noise on flow fluctuations, Eq. (1) can be modified[4] to

$$\langle|\delta\alpha(z,i\omega)|^2\rangle = \frac{V}{A}\,\frac{v_0\alpha(z)}{v^2(z)} \tag{2}$$

where v_0 is the velocity at the inlet of the cooling channel of BWRs.

The space cross correlation of noise sources has been treated in detail numerically and analytically in Refs. 4 and 5, respectively, and it has been found that the noise sources are weakly correlated in space.

Further investigations are required to study the frequency composition of BWR noise, since the comparison of theoretical and experimental APSD clearly indicates[4] that the BWR noise is not white in the frequency domain.

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Response to the "Comments on 'Numerical Calculations of the Global and Local Components of the Neutron Noise Field in Boiling Water Reactors' "

In response to the remarks of Singh and John,[1] we point out that in our paper,[2] we showed that by approximating the so-called global component of the neutron noise field in a boiling water reactor with a point kinetics model, stochastic observably can be calculated using deterministic thermal-hydraulic computer codes. The necessary algebra was developed resulting in Eqs. (28) and (36) of Ref. 2, which explicitly depend on the auto power spectral density (APSD) of the void fraction noise.

In the numerical part of our paper, we choose to use the Kosaly et al.[3] formulation of the void fraction APSD for demonstration purposes, but other appropriate models could be used. More accurate formulations of this APSD when introduced in our model will certainly produce calculated results closer to the experimental.

We welcome the comments of Singh and John[1] and appreciate their interest in our paper.

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