

Additional Comments on "The Effect of Random Material Density on Reactor Criticality"

I welcome the opportunity that Dr. Sakhnovsky's communication¹ gives me to correct some errors in my paper, "The Effect of Random Material Density on Reactor Criticality."² These errors also appear in my book, *Random Processes in Nuclear Reactors*.³ However, while presenting a course of lectures on stochastic processes in nuclear reactors to the Comitato Nazionale per l'Energie Nucleare in Rome in 1980, such errors came to light. In the published version of those lectures in the SCOPE series,⁴ the correct equation is derived.

I also take this opportunity to present the correct limiting forms of the complex buckling, which is a root of

$$B^2 - B_0^2 = \frac{\langle \epsilon^2 \rangle B_0^4 I^2}{B^2 I^2 + (1 - iB_0 I)^2},$$

where

$\langle \epsilon^2 \rangle$ = mean square average of the buckling fluctuation as defined by Sakhnovsky¹

I = correlation length of the fluctuation, assuming an exponential autocorrelation function

B_0^2 = unperturbed buckling.

For small $B_0 I$, we find

$$B = B_r + iB_i = 1 + \frac{1}{2} \langle \epsilon^2 \rangle B_0^2 I^2 + i \langle \epsilon^2 \rangle B_0^3 I^3.$$

Thus, as stated by Sakhnovsky,¹ and by me in the SCOPE publication,⁴ randomness decreases the critical size.

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REFERENCES

1. E. G. SAKHNOVSKY, *Nucl. Sci. Eng.*, **104**, 197 (1990).
2. M. M. R. WILLIAMS, *Atomkernenergie*, **22**, 248 (1974).
3. M. M. R. WILLIAMS, *Random Processes in Nuclear Reactors*, Pergamon Press, Elmsford, New York (1984).
4. M. M. R. WILLIAMS, "Stochastic Processes in Nuclear Reactors," *SCOPE Series on Random Processes*, CNEN, Rome, Italy.