of the approach suggested by Gandini,[1,2] utilizing the Italian GPT chain.[7-9] For investigations of the "near-range" effects described above, the x value of interest is generally very near the location of the zonal peak power density.[3] However, to test the proposed method, we chose points in our simple model where both the derivatives $R^{(1)}$ and $R^{(2)}$, and the perturbations thereof, $\delta R^{(1)}$ and $\delta R^{(2)}$, were expected to be appreciable. Since GPT calculates $\delta R^{(i)}$, to avoid loss of significant figures for small perturbations we evaluated the following expression, rather than using Eq. (3) directly:

$$\delta R(x) = \delta R(x_0) + \delta R^{(1)}(x_0)(x - x_0) + \frac{1}{2}\,\delta R^{(2)}(x_0)(x - x_0)^2 \ . \tag{4}$$

For our test calculations, we considered a two-region, one-dimensional slab with sodium, ^{238}U, and ^{239}Pu core and blanket concentrations characteristic of an LMFBR, e.g., those of the test model of Ref. 11. The core and blanket thicknesses were 80 and 30 cm, respectively, and the three-group core cross-section set of the CITATION test case[12] was employed.

A sample perturbation that we considered was a 10% decrease in the core ^{239}Pu density (N_c^{49}) and an addition of ^{239}Pu with a number density of 0.15 N_c^{49} to the blanket. The space range of interest was approximately the middle half of the core, because of the eventual interest in peak power density investigations. While our goal was not to address the agreement between $\delta R_D(x)$ determined by direct calculations and $\delta R_P(x)$ from normal GPT, the ratio of these two values for the above perturbation did not deviate from 1.0 by more than ~10% in the space range of interest. This agreement is obviously a function of the perturbation magnitude, and was within 2% for smaller test perturbations.

To examine the appropriateness of the Taylor series expansion used in GPT, for the above sample perturbation we compared $\delta R_P(x)$ determined by normal GPT at x with $\delta R_{PT}(x)$ resulting from Eq. (4), with all $\delta R^{(i)}(x_0)$ determined by GPT.

We considered several cases in the space range of interest, with $(x - x_0)$ values of 6 cm and $\delta R(x_0)$ and $\delta R(x)$ values that differed by almost a factor of 2. For these cases, the ratio $\delta R_{PT}(x)/\delta R_P(x)$ did not differ from 1.0 by more than ~10%. (For regions near the blanket the agreement was poorer, but these regions are not of general interest for investigations of maximum power densities.)

[11] J. M. KALLFELZ et al., *Nucl. Sci. Eng.*, **62**, 304 (1977).

[12] T. B. FOWLER et al., "Nuclear Reactor Analysis Code: CITATION," ORNL-TM-2496, Rev. 2, Oak Ridge National Laboratory (1971).

Thus the Taylor series expansion method suggested by Gandini[1,2] for GPT appears promising for GPT investigations of point power density sensitivities. For a spatial scan of power density sensitivities, this method can potentially reduce considerably the number of necessary Γ^* calculations. Investigation of this method for various applications and perturbations is continuing.

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Response to "On the Taylor Series Expansion with Generalized Perturbation Methods"

Although preliminary, the results obtained by Perone et al.[1] seem quite encouraging. They again indicate the potentiality of the generalized perturbation theory (GPT) methods in the solution of crucial problems in reactor safety and project domains, apart from the significant insight into complex mechanisms regulating the neutron economy of multiplying systems, which is gained by their use. The quantity specifically analyzed by the authors is the power factor at different (in particular at peak power) reactor positions. There is no doubt that a full understanding of the dependence of such a quantity on basic data (and their inaccuracies), or project parameters, will be highly helpful, either in defining with confidence the operational margins of a power system, or in optimizing its performance in terms of both maximal overall power level and average fuel burnup at the end of cycle.

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[1] VINCENT A. PERONE, JOHN M. KALLFELZ, and LOTFI A. BELBLIDIA, *Nucl. Sci. Eng.*, **79**, 326 (1981).