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Comment on "Analysis of Cluster Geometries Using the DP1 Approximation of the $J_\pm$ Technique"

This letter is in response to statements made in Sec. I of Ref. 1. Specifically, I wish to point out that the following statement is totally incorrect: "Most calculations performed to date using the $J_\pm$ method for two-dimensional geometries made use of the DP_0 approximation, where only isotropic angular fluxes at each interface are considered.[6–8]"

First, Marleau and Hébert's[1] reference to the work of Cheng, McDaniel, and Leonard[2] (listed as Ref. 6 in Ref. 1) and that of Anderson and Honeck[3] (listed as Ref. 7 in Ref. 1) as having applied only the DP_0 approximation in two-dimensions is wrong. Second, Marleau and Hébert appear to be unaware of or to ignore a number of publications from 1975 to 1987 on the use of the interface current ($J_\pm$) technique with higher angular current approximations (DP_1 and DP_2). These include some publications on the use of the $J_\pm$ technique with higher angular current approximations in combination with the first-flight collision probability technique in exactly the type of fuel cluster geometry as in Ref. 1.

It is well known[4] that in one- or two-dimensional geometry, the DP_0 approximation corresponds to only a one-term half-space angular current expansion (cosine current). The DP_1 approximation results in a two-term expansion[5] in slab geometry and a three-term expansion[3] in two-dimensional geometry. The work of Cheng, McDonald, and Leonard[2] was the first attempt to improve the $J_\pm$ technique in two dimensions by considering a two-term expansion better than DP_0. The full DP_1 expansion was used in two dimensions for the first time by Anderson and Honeck[3] and Anderson.[6] Subsequently, Häggblom and Ahlin,[7] Mesina and Emendorfer,[8] Maedar,[9] Sanchez,[10] Wasastjerna,[11] Saji et al.,[12] and Stepanek[13] used the DP_1 approximation to represent angular currents at region interfaces. In most cases, general formulations with the DP_N approximation were given. But, the results were restricted to DP_0 and DP_1 in all the foregoing cases. Since the expansion coefficients are different on the four sides of a rectangle, Maedar called it quadruple P_1 expansion. Wasastjerna termed it sextapole P_1 expansion as applied to hexagons. Out of these, Mesina and Emendorfer,[8] Sanchez,[10] and Saji et al.[12] considered heterogeneous fuel assembly (fuel rods in a square assembly) problems. Also, Sanchez[10] used the $J_\pm$ technique to couple cell regions inside which only the collision probability technique was used. I[14] used the DP_2 approximation (six-term expansion) for two-dimensional problems to improve the predictions of the $J_\pm$ technique, especially in problems with controlled fuel assemblies. A four-term expansion, which is nearly equivalent to the full DP_2 expansion, was also identified.[14]

In the meantime, Krishnani and Srinivasan[15] had applied the $J_\pm$ technique with the DP_0 approximation to couple rod cluster rings, within which the collision probability technique was used, of pressurized heavy water reactor (PHWR) fuel clusters. Later, Krishnani[16] used DP_1 and DP_2 approximations of angular currents in the above method to get more accurate results for PHWR fuel clusters. He applied[17] this method to light water reactor assemblies also.

In view of all the aforementioned developments, the first-mentioned statement of Marleau and Hébert shows that either they are working in isolation or they do not give adequate credit to previous work in the same field.

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