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# Polynomial Axial Expansion for 3D method of characteristics applied to neutron transport

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In the recent years a solver based on the Method of Characteristics (MOC) allowing the treatment of 3D extruded geometries has been developed inside the TDT module of APOLLO3®. The standard Step Characteristics (SC) approximation is used and results show an excellent agreement with Monte-Carlo simulations. However a fine mesh refinement is needed to converge the strong flux gradients customarily appearing in 3D reactor physics applications. An improvement of this method is proposed: the results of the previous work show that much of the flux variations are likely to be represented by a polynomial basis along the vertical direction. Since most of the geometrical and physical heterogeneities are radially located, the SC approach is preserved to represent the solution over the radial plane. As a matter of fact the strong irregularities in the geometrical meshes prevent from an efficient use of a polynomial expansion. On the contrary along the axial direction the computational meshes assume a Cartesian shape, well suited for a polynomial representation of sources and fluxes. A convenient polynomial development in this direction allows us to approximate the strong flux slopes without the help of a large number of axial meshes.

**Auteur principal:** M. GRAZIANO, Laurent (CEA)

**Co-auteurs:** M. SCIANNANDRONE, Daniele (CEA); M. SANTANDREA, Simone (CEA)

**Orateur:** M. GRAZIANO, Laurent (CEA)

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