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A second-order method for convection-diffusion equation across interfaces separated by boundaries of flow[1] XIANGLONG WANG, University of Michigan and Tulane University, MARK MEYERHOFF, University of Michigan, JOSEPH BULL, Tulane University — Biological mass transport often involves transport across interfaces separated by presence of flow. An example is the recent development of nitric oxide releasing catheters that release nitric oxide into the bloodstream to prevent biofilm formation. The presence of flow often creates large gradients in mass concentration with sharp contrast in Peclet numbers across the interface. Solving such problems with computational methods are challenging, since proper shock capturing methods are essential to resolve these shocks. Our goal is to accurately resolve the shocks present in convection-diffusion problems separated by boundaries of flow. To achieve this goal, we developed a 3D Cartesian-coordinates based method on a model problem simulating release of substance-doped catheters into the bloodstream on a non-orthogonal hexagonal grid. We applied proper directional slope limiting for calculating convection flux and multi-point flux approximation (MPFA) L-method for calculating diffusion flux. This method allows us to achieve stable solutions of the convection-diffusion equation in our model problem with near second-order accuracy for local Peclet numbers up to 5.0. The ability of perform such simulation is essential for guiding the development of nitric oxide releasing catheters.

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