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Developing a weakly compressible smoothed particle hydrodynamics model for biological flows[1] YAROSLAV VASYLIV, ALEXANDER ALEXEEV, Georgia Institute of Technology — Smoothed Particle Hydrodynamics (SPH) is a meshless particle method originally developed for astrophysics applications in 1977. Over the years, limitations of the original formulations have been addressed by different groups to extend the domain of SPH application. In biologically relevant internal flows, two of the several challenges still facing SPH are 1) treatment of inlet, outlet, and no slip boundary conditions and 2) treatment of second derivatives present in the viscous terms. In this work, we develop a 2D weakly compressible SPH (WCSPH) for simulating viscous internal flows which incorporates some of the recent advancements made by groups in the above two areas. The method is validated against several analytical and experimental benchmark solutions for both steady and unsteady laminar flows. In particular, the 2013 U.S. Food and Drug Administration benchmark test case for medical devices – steady forward flow through a nozzle with a sudden contraction and conical diffuser – is simulated for different Reynolds numbers in the laminar region and results are validated against the published experimental and CFD datasets.

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