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One-Dimension Model for Positive Displacement Pump with Cavitation Algorithm

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Abstract : The simulation of a positive displacement pump system with commercial software for Computer Fluid Dynamics (CFD), will result in an enormous computational effort due to the complexity of the pump system. This drawback restricts the use of it to a specific part of the pump in one simulation. This research focuses on developing an algorithm that provides a suitable result in agreement with experiment data, without that computational effort. The compressible equations are solved with an explicit algorithm. A comparison is presented between the FV method with Monotonic Upwind scheme for Conservative Laws (MUSCL) with slope limiter and experimental results. The source term for cavitation and friction is introduced into the algorithm with a slipping strategy and solved with a 4th order Runge-Kutta scheme (RK4). Different pumps are modeled and analyzed to evaluate the flexibility of the code. The simulation required minimal computation time and resources without compromising the accuracy of the simulation results. Therefore, this algorithm highlights the feasibility of pressure pulsation simulation as a design tool for an industrial purpose.

Keywords : cavitation, diaphragm, DVCM, finite volume, MUSCL, positive displacement pump
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