

An implicit finite volume solver is developed for the steady-state solution of generalised Newtonian fluids on unstructured meshes in 2D. The pseudo-compressibility technique is employed to couple the continuity and momentum equations by transforming the governing equations into a hyperbolic system. A second-order accurate spatial discretisation is provided by performing a least-squares gradient reconstruction within each control volume of unstructured meshes. A central flux function is used for the convective terms and a solution jump term is added to the averaged component for the viscous terms. Global implicit time-stepping using successive evolution–relaxation is utilised to accelerate the convergence to steady-state solutions. The performance of our flow solver is examined for power-law and Carreau–Yasuda non-Newtonian fluids in different geometries. The effects of model parameters and Reynolds number are studied on the convergence rate and flow features. Our results verify second-order accuracy of the discretisation and also fast and efficient convergence to the steady-state solution for a wide range of flow variables.