

## Numerical analysis of Newtonian flows based on artificial compressibility $AC$ method

Bashaer K. Jassim      Alaa H. Al-Muslimawi  
University of Basrah, College of Science, Department of Mathematics  
Email: bashaeir90@yahoo.com

Recived : 28\9\2017

Revised : 8\10\2017

Accepted : 16\10\2017

### Abstract

In this study, numerical analysis for incompressible Newtonian flows has been conducted by using an artificial compressible method ( $AC$ -method) based on the Galerkin finite element approach. As well known, Navier-Stokes partial differential equations are employed to describe activity of the fluid. This model, which consists of two differential equations; named the conservation of mass and time-dependent conservation of momentum is presented in cylindrical coordinates system (Axisymmetric flow). The effects of many factors such as Reynolds number ( $Re$ ) and artificial compressibility parameter ( $\beta_{ac}$ ) are discussed in the present study. In particular, this study emphasized on the impact of these parameters on the level of convergence. To satisfy the analysis of the method, Poiseuille flow along a circular conduit under isothermal condition is utilized as a simple test problem. This test is conducted by taking a circular cross section of pipe.

**Keywords:** Finite Element Methods; Galerkin Method; Navier-Stokes; Artificial Compressibility Method; Newtonian Flow

**Mathematics Subject Classification 2010 :**35Q30, 65M60