

1067-34-1964

William S. Janna* (wsjanna@memphis.edu), Department of Mechanical Engineering, Memphis, TN 38152, and **Karyn M Bautista** (kmbtista@memphis.edu), Department of Mechanical Engineering, Memphis, TN 38152. *An Approximate Method for Obtaining a Polynomial Solution to the Problem of the Unsteady Velocity-Time History of Flow Startup in a Duct.*

An incompressible fluid is initially at rest in a duct. At some initial time, a valve is opened and due to external forces, the fluid accelerates to a steady state velocity. The mathematical model for finding the average steady state velocity is a nonlinear, first order, ordinary differential equation, which contains pressure, gravity, friction, and acceleration terms. The traditional solution method involves a linearization technique where the nonlinear term is assumed constant, and equal to its steady state value. A second solution method involves a numerical technique using a finite difference scheme. In this study, a third method of generating a velocity-time history in polynomial form is presented as an alternative technique. These methods are used to solve a specific example to obtain results that can then be compared. The indication is that the polynomial method compares favorably with the linearized solution, and so it can be used as an additional technique to describe the motion of an accelerating fluid. (Received September 22, 2010)