

A Numerical Study for Fluid Flow Around Different Shapes of Bridge Pier

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Abstract

The study of the influence of the bridge piers is still active research topic of interest. The effect of Reynolds number (Re) on the drag coefficients (C_D) due to water flow around piers is simulated numerically by solving Navier-Stokes equations. The piers are modelled with different shapes of pier cross section. The comparative studies among the drag coefficients of circular, rectangular, square, octagonal, elliptic and lenticular shaped bridge piers are carried out. A numerical algorithm is presented to explore the influence of variation of velocity on the hydrodynamic force and pressure distribution exerted on piers. The hydrodynamic interactions between wall and fluid medium are presented herein with the help of velocity and pressure contour plots. A significant finding is that the shape of the pier cross section has a significant effect on the fluid pressure exerted on bridge piers. This helps understand the appropriate shape of the bridge piers to be interested in the real applications.

Keywords

Bridge Pier, Drag Coefficient and Navier-Stokes equations.

Biographies

Mr. Anwar Ahmad Siddiquee is a student of University of Chittagong. He has obtained his Bachelor of Science (Honours) degree from Department of Mathematics under Faculty of Science. At present he is pursuing his Master of Science degree (thesis group) under the same department. His research interests are in the area of Computational and Experimental Fluid Dynamics, Data Analysis and Mathematical Optimization. Currently he is conducting a research work on fluid flows around the different shapes of bridge piers. In this study he is using Navier-Stokes equations to numerically simulate the effect of Reynolds Number (Re) on the Drag Coefficients (C_D) due to water flow around piers. This experiment will find the significant effect of the appropriate shape of the pier cross section on the fluid pressure exerted on bridge piers.

Dr. Mohammad Jalal Ahammad is the Senior Professor of University of Chittagong. He has 20+ years of teaching and research in the field of Mathematics and its applications in real life. He finished M.Sc. and M. Phil from University of Chittagong, Bangladesh. Then he moved to Canada to pursue his M.S. in Computational science from Memorial University of Newfoundland. Finally, he was awarded PhD in the field of applied sciences and Engineering from the Memorial University of Newfoundland, Canada. Dr. Ahammad developed different numerical approaches to study flow through porous media during his research in Canada and he also developed experimental tools to investigate near wellbore flow phenomena considering turbulent flow. He successfully has used Navier-Stokes equations and phase field technique in the field of oil reservoir studies. Recently, he has worked as post-doctoral fellow under the prestigious MITAC cluster fund with the collaboration of Anaconda gold mining company and Memorial University. He worked at the Memorial University of Newfoundland, Canada; Chittagong University; Primer University; BGC trust University, and University of Science and Technology Chittagong, Bangladesh in different positions. Dr. Ahammad is holding the Associate Vice-President (AVP) position at Science (SCI) Unit of OE Division, NSRIC. He is also the Senior Faculty in the area of Mathematics and Deputy Country Manager (Marketing) for Bangladesh. Dr. Ahammad is also the advisor of the IEOM Chittagong university chapter. This academic scholar has published over 20 research papers in different peer-reviewed reputed international journals. His main research interests are in the area of multiphase flow through porous media, developing numerical technique in the field of CFD, designing experimental tools for fluid flows.