10th International Congress on Civil Engineering, 5-7 May 2015
University of Tabriz, Tabriz, Iran

Comparison of VOF and Mixture models in numerical simulation of flow patterns in curved channels

salma ajeel[1], Azadeh Gholami [2], Hossein Bonakdari [3, *], Ali Akbar akhtari [4, *]

[1] M.Sc. Student, Department of Civil Engineering, Razi University, Kermanshah, Iran

[2] Ph.D. Student, Department of Civil Engineering, Razi University, Kermanshah, Iran.

[3]Associate Prof, Department of Civil Engineering, Razi University, Kermanshah, Iran.

[4] assistant Prof, Department of Civil Engineering, Razi University, Kermanshah, Iran.

[*] Water and Wastewater Research Center, Razi University, Kermanshah, Iran.

gholami.azadeh@yahoo.com

ABSTRACT

In this study, free surface and pattern of Flow through a 90° sharp bend, Using FLUENT software, and utilizes both VOF and Mixture models with $k-\varepsilon$ (RNG) turbulence model have been simulated. To verify the numerical models, experimental results conducted in this research is used. The results indicate that both models are well able to predict the flow pattern of the bend. But the VOF models with an 0.03 average error reffer to the Mixture model with 0.125 Average error to better fit with the experimental results.

Keywords: VOF model, Mixture model, numerical simulation, flow pattern, sharp bend.

1. INTRODUCTION

With flow entrance the bend, the effect of centrifugal force and interaction with lateral gradient of pressure from the transverse slope of the water surface, a process called secondary flow is formed. In this kind of flow, the flow in the upper part of the river are driven to the outer wall and in the lower part of the river, to the inner wall. So part of the bend in the river, is critical parts in identifying the hydraulic behavior of the river. Understanding the flow hydraulic in river bends, longitudinal and transversal velocities, shear stresses and the turbulence and complexity has attracted the attention of many researchers. Shukry (1950) and Rosovskii (1957) were the first people on the pattern of flow in curved channels were investigated [1, 2]. The laboratory research work has been done can be steffler et al. (1985), Blanckaert and Graf (2001) and Blanckaert and DeVriend (2004) pointed out [3, 4, 5]. Several numerical investigation on the flow pattern of the bend is taken. (Lu et al., 2004) using the SIMPLEC algorithm has been modified to Numerical study on the free surface of a curved channel 180°. They also review the free surface of a *free surface velocity-pressure-correction method* and continuity equations were integrated in the depth of the channel. The researchers found that in the curved portion of the channel width, initially at 0-90° to the inner wall and then at 90-180° tilted toward the outer wall [6]. DeMarchis and Napoli (2006) investigate the three-dimensional numerical flow at a 270° sharp bend. They examine the distribution of profiles and components of velocities and water surface level, Navier-stockes equations governing equations using $k-\varepsilon$ turbulence model is used. They are also calculated the water level changes and presented equation based on kinematic condition, This equation is based on the hydrodynamic model has been developed that is capable of moving boundaries shown on the flow field [7]. Zeng et al., (2010) using the Eddy Simulation (DES) to study the flow pattern in open channels With a 193° sharp bend and most satisfactory results of the velocity distribution in main flow and presentation of secondary currents in cross sections showed. They were based on the bathymetry of the channel showed that along the bend, around the outer wall erosion there [8]. Naji Abhari et al., (2010) studied flow patterns at 90° sharp bend with Numerical simulation and experimental model. They used