CHARACTERIZATION OF FLUID FLOW USING DISCRETE VORTEX MODELLING

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ABSTRACT

There has been growing need to characterize the fluid flow through a simplified model. This paper reports the ”random walk model” for characterization of fluid flow through the use of ‘boundary layers by discrete vortex modeling’ The soil erosion is considered as a case study. The research work covered three distinct regions of fluid flow namely the laminar region, the transition region and the turbulent region. Appropriate flow charts and FORTRAN source codes were developed to solve relevant fluid flow governing equations. Reynolds number which is the control parameter from 10,000 at an interval of 10,000 to 1,000,000 is used as the control parameter to tune from laminar to turbulent flow and the result is displayed using Microsoft Excel Graph. The first region characterizes laminar region with regularity, stability, high momentum diffusion and low momentum convection. The second region is the transition region, which shows the onset of irregularity and instability. After several stages of transition process due to Helmholtz instability, the turbulent region is reached which is characterized by irregularity, instability, low momentum diffusion, high momentum convection and rapid variation of velocity. The result shows that fluid flow can be characterized through the use of discrete vortex modeling.

KEYWORDS: Discrete Vortex Modeling, Distinct Regions, Fluid Flow, Momentum Convection, Momentum Diffusion, Regularity, Reynolds Number, Soil Erosion, Stability