Coupled Systems Mechanics, *Vol. 5, No. 3 (2016) 203-221*
DOI: https://doi.org/10.12989/csm.2016.5.3.203

1D contaminant transport using element free Galerkin method with irregular nodes

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(Received February 9, 2016, Revised November 4, 2016, Accepted November 7, 2016)

Abstract. The present study deals with the numerical modelling for the one dimensional contaminant transport through saturated homogeneous and stratified porous media using meshfree method. A numerical algorithm based on element free Galerkin method is developed. A one dimensional form of the advective-diffusive transport equation for homogeneous and stratified soil is considered for the analysis using irregular nodes. A Fortran program is developed to obtain numerical solution and the results are validated with the available results in the literature. A detailed parametric study is conducted to examine the effect of certain key parameters. Effect of change of dispersion, velocity, porosity, distribution coefficient and thickness of layer is studied on the concentration of the contaminant

Keywords: contaminant transport; irregular nodes; homogenous and stratified porous media; meshfree methods; element free Galerkin method

1. Introduction

The groundwater pollution due to contaminant transport from landfills and lagoons has been a major concern. Contamination is caused by landfills, lagoons, industries and factories. In order to adopt preventive measures, the extent of migration of contaminants must be known accurately. From the basic principles, the phenomenon of contaminant transport can be expressed in the form of governing differential equation, consisting of molecular diffusion, advection and sorption. Patil and Chore (2014) presented an overview of the various numerical and experimental studies on the contaminant transport. Analytical solutions find a very attractive approach for the flow equations (Ogata and Banks 1961, Van Genuchten 1981, Rowe and Booker 1989, Chen *et al.* 1989). Analytical solutions are very effective for homogenous isotropic medium and simple geometry; but they cannot be applied to complex groundwater problems encountered and hence, the need for an effective numerical technique arises.

The numerical methods like finite difference method (Mirbagheri 2004, Chakraborty and Ghosh 2010, Sharma *et al.* 2014) and the finite element method (Javadi and Al-Najjar 2007, Cooke and Rowe 2008) perform better while handling problems of complexity, heterogeneity and anisotropy.

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http://www.techno-press.org/?journal=csm&subpage=8 ISSN: 1598-8198 (Print), 1598-818X (Online)

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