MATHEMATICS Colloquium 2022

New Numerical Approximations to Solve Partial Differential Equations Modelling Geological Processes in Heterogeneous Systems

20 JANUARY

4.30 PM - 5.30 PM

ABSTRACT

This talk will mainly focus on the applications of partial differential equations (PDEs) in geology. On the more technical side, this talk will focus on using the Finite Difference-based Radial Basis Functions (RBF-FD) method to solve groundwater flow equations in a heterogeneous geological environment. With this procedure, we combine RBFs' strengths in representing complex geometries with its ability to discretize differential operators accurately and attain a new robust modeling approach for stably and accurately computing the solution even in the vicinity of active wells mathematically represented as singularities. We validate our method and verify its high order of accuracy by solving a well-known benchmark problem. Numerical results of the work will be presented and compared to results obtained with the USGS Finite Difference-based software MODFLOW that is customarily used by the geological community. Furthermore, a novel methodology to solve partial differential equations that model fractures in porous media will also be introduced.

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Nadun Dissanayake

B.Sc.(Perad.), M.Sc. , Ph.D.(MTU,USA).

Nadun Dissanayake is an Assistant Professor of Mathematics at the Department of Mathematical Sciences, Appalachian State University. His research interests are in the field of applied and computational mathematics. He interested in developing higher-order robust numerical methods to solve partial differential equations. He mainly focus on meshless methods such as the Radial Basis Functions Method. These methods can be applied to many problems, such as modeling groundwater flow.

Contact :
Dr. Chathurika Athapattu / Mobile : 077-9226491/ Email : chathurikaa@sci.pdn.ac.lk
Dr. Chathuranga Mudalige / Mobile: 071-9887144 / Email : chathuranga.mudalige@sci.pdn.ac.lk

Organized by : The Department of Mathematics, Faculty of Science, University of Peradeniya