PFLOTRAN: A massively parallel simulator for groundwater flow and transport

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Abstract

PFLOTRAN is a massively parallel simulator for coupled subsurface flow and transport processes. It is designed to solve partial differential equations for groundwater flow and transport with parallel performance on a large number of processors, with possible scalability to large computer systems. It is the result of a major effort and is based on a general purpose subsurface flow simulation model, FLOTRAN. This paper describes PFLOTRAN and its potential as a new subsurface simulator for coupled subsurface flow and transport processes.

Architecture of PFLOTRAN

PFLOTRAN comprises of two major modules: FLOTRAN and PFLOTRAN-TOUGH2. FLOTRAN is a coupled subsurface flow and transport simulation module, while PFLOTRAN-TOUGH2 is a coupled subsurface flow and transport simulation module based on TOUGH2. FLOTRAN and PFLOTRAN-TOUGH2 are coupled through a common interface, which allows the user to specify the coupled processes and the coupling method.

Mathematical formulation

PFLOTRAN uses the finite element method to solve the governing equations for groundwater flow and transport. The governing equations are transformed into a system of algebraic equations, which are then solved using iterative techniques.

Performance and scalability

PFLOTRAN is designed to be scalable and efficient on large computer systems. It is designed to solve large-scale problems with a large number of processors, with possible scalability to large computer systems. It is the result of a major effort and is based on a general purpose subsurface flow simulation model, FLOTRAN. This paper describes PFLOTRAN and its potential as a new subsurface simulator for coupled subsurface flow and transport processes.

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