

PACKAGE ID - 001227SGIIN00 FACT

KWIC TITLE - Flow and Containment Transport Code for
Modeling Variably Saturated Porous Media

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LIMITATION CODE -COPY **AUDIENCE CODE** - LIM

COMPLETION DATE - 01/01/1998 **PUBLICATION DATE** - 01/01/1998

DESCRIPTION - FACT is a finite element based code designed to model subsurface flow and contaminant transport. It was designed to perform transient three-dimensional calculations that simulate isothermal groundwater flow, moisture movement, and solute transport in variably saturated and fully saturated subsurface porous media. The code is designed specifically to handle complex multi-layer and/or heterogenous aquifer systems in an efficient manner and accommodates a wide range of boundary conditions. Additionally 1-D and 2-D (in Cartesian coordinates) problems are handled in FACT by simply limiting the number of elements in a particular direction(s) to one. The governing equations in FACT are formulated only in Cartesian coordinates. FACT writes out both ascii and graphical binary files that are TECPLOT-ready. Special features are also available within FACT for handling the typical groundwater modeling needs for remediation efforts at the Savannah River Site.

PACKAGE CONTENTS - Media Directory; Software Abstract: WSRC-TR-95-0223;
Media Includes Source Codes, User's Guide, Executable Module,
Object Module;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 3.5 Diskettes

METHOD OF SOLUTION - FACT efficiently handles large 3D problems based on state-of-the-art finite element formulations and nonlinear solution procedures/features such as; analytical influence matrix coefficients to avoid costly numerical integration; matrix solution is obtained with preconditioned conjugate gradient-like (PCG) solvers; finite element or finite difference stencil for handling the Laplace operator; Picard, full Newton-Raphson, or modified

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METHOD OF SOLUTION - (CONT) Newton-Raphson iteration procedure options; upstream weighting of relative permeabilities available; transport upstream weighting to help circumvent numerical oscillations.

COMPUTER - SGI INDIGO

OPERATING SYSTEMS - UNIX SGI IRIX 5.2, 5.3, 6.2

PROGRAMMING LANGUAGES - Fortran

SOFTWARE LIMITATIONS - The code is tailored to isothermal unsaturated and fully saturated porous medium systems (solves the Richard's equation). Flow and transport in fractured systems are not taken into account. The code handles only single-phase flow (i.e. water) and ignores the flow effects from other potential phases (i.e. air or other non aqueous phases) which, in some instances, can be significant. Non-Darcy flow that may occur near pumping wells is neglected.

SOURCE CODE AVAILABLE (Y/N) - Y

UNIQUE FEATURES - Fact was developed to have not only the essential modeling capabilities, but also some salient features that help facilitate its practical use. An overview of these aspects of FACT are: utilizes C dynamic memory allocation; performs steady state and/ or transient analyses of both variably saturated isothermal groundwater flow and isothermal solute transport problems; handles highly nonlinear moisture characteristics, material heterogeneity and anisotropy, and rapidly fluctuating transient boundary conditions; various matrix connectivity options are provided (e.g. finite element or finite difference stencil for handling of the Laplace operator) for addressing the accuracy of the simulation with respect to computational speed and storage demands; several iteration strategies are available for solving the nonlinear flow equations; for highly heterogeneous aquifers an option to incorporate some degree of upstream weighting of the relative permeabilities is available.

RELATED SOFTWARE - Graphical output files from the FACT code are TECPLOT ready. TECPLOT is a commercially available interactive graphics tool outside the domain of this software and is used in conjunction with FACT.

OTHER PROG/OPER SYS INFO - No other proprietary software is required. FACT is mainly written in ANSI standard FORTRAN 77. Some widely-accepted extensions to FORTRAN 77 have been used, such as INCLUDE, POINTER statements and variable names longer than 6 characters. The code should compile under most standard computer systems. The memory allocation and binary Tecplot functions require a C compiler.

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HARDWARE REQS - Disk storage requirements depend mainly on whether the chosen problem and solution technique (picard versus Newton) yield a symmetric or non-symmetric matrix and the number of nodes/elements. Dynamic memory allocation yields minimum storage needs.

TIME REQUIREMENTS - FACT efficiently solves the 3D variably saturated flow and/or transport equations. every effort has been taken to reduce CPU demands. However, run time demands are ultimately dictated by the nodal size and type of problem being solved. Flow/transport problems with over 200,000 nodes have been solved on SGI workstations.

ABSTRACT STATUS - Released AS-IS 8/20/1998.

SUBJECT CLASS CODE - HR

KEYWORDS -

COMPUTER PROGRAM DOCUMENTATION
F CODES
FINITE ELEMENT METHOD
FINITE DIFFERENCE METHOD
NEWTON METHOD

EDB SUBJECT CATEGORIES -

990200

SPONSOR - DOE/DP

PACKAGE TYPE - AS - IS