

SOFTWARE REVIEW

Review of FEHM

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FEHM (Finite Element Heat and Mass transfer) is a powerful and versatile numerical code useful for simulating nonisothermal, multiphase flow and transport through complex 3-D geologic media. The model was developed by researchers at Los Alamos National Laboratory (LANL) with the primary intent to facilitate understanding of transport in the unsaturated and saturated zone below the potential Yucca Mountain waste repository, but its use has been extended to a variety of geologic settings. FEHM is capable of tracking the movement of multiple gas and liquid constituents that chemically react and adsorb, as well as handling the transport of solutes that partition between the liquid and gas phases according to Henry's Law. Dual porosity and dual porosity/dual permeability features are used to represent flow and transport through fractured media. Transient adjustments in geologic properties resulting from temperature and pore-fluid pressure changes are accommodated using the coupled stress module. FEHM's particle-tracking formulation is useful for colloidal transport, radioactive contaminant migration, and well-head delineation.

Unlike most codes designed to address unsaturated zone flow, FEHM incorporates isothermal and nonisothermal water vapor flow, which is of particular importance in describing unsaturated flow in many arid and semiarid regimes. Available relative permeability formulations include simple linear functions, Corey relationships, van Genuchten functions, and composite curves.

Another strong point of FEHM is its ability to represent complex geologic media, which is accomplished using grid generation tools developed to interface with FEHM and produce unstructured or structured grids. Unstructured grids provide a vast improvement over structured grids for representing faults, stratigraphic pinch-outs, and abrupt changes in topography.

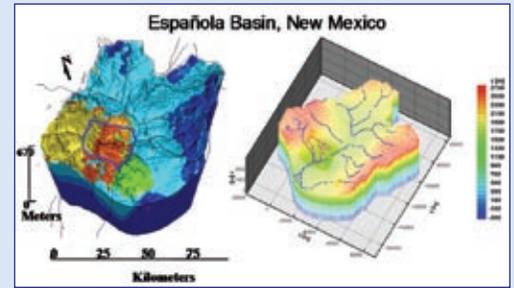
At present, FEHM does not have a

graphical user interface. All user-provided input must be entered in text files using a specified format. This feature results in a rather long learning curve. But once input templates have been developed for a given problem, various parameters can be easily modified. FEHM is set up to interface with PEST, a parameter estimation routine.

Use of FEHM has generally been limited to researchers at LANL and their colleagues. UNIX and PC executables of the code, a user manual, and code documentation can be obtained free of charge by contacting LANL (www.ees5.lanl.gov/fehm/).

Limited technical support via email may be available as time allows: contact George Zyloloski (gaz@lanl.gov) or Bruce Robinson (robinson@lanl.gov). LANL periodically offers FEHM workshops for users. This review does not imply endorsement of FEHM by the U.S. Geological Survey.

Review of FEHM



Ease of Use:	★★★★	Best Features	Capabilities to address a wide range of complex flow and transport problems
GUI:	N/A	Worst Feature	No GUI available at present
Application:	★★★★		
Output/Plotting:	N/A		
Documentation:	★★★★		
Speed:	★★★★		
OVERALL RATING:	★★★★		

Rating System



Excellent



Poor



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