PACKAGE ID - 000160C760000 WELBORE

KWIC TITLE - Transient Wellbore Fluid Flow Model

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LIMITATION CODE -UNL **AUDIENCE CODE -** UNL

COMPLETION DATE - 03/01/1982 **PUBLICATION DATE -** 03/04/1992

DESCRIPTION - WELBORE is a code to solve transient, one-dimensional two-phase or single-phase non-isothermal fluid flow in a wellbore. The primary thermodynamic variables used in solving the equations are the pressure and specific energy. An equation of state subroutine provides the density, quality, and temperature. The heat loss out of the wellbore is calculated by solving a radial diffusion equation for the temperature changes outside the bore. The calculation is done at each node point in the wellbore.

PACKAGE CONTENTS - NESC Note; Software Abstract; LBL-10910; Media Includes Source, Sample Problem;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 CD Rom

METHOD OF SOLUTION - The program uses a partially implicit method to solve by a finite-difference method the Navier-Stokes equations of mass, momentum, and energy. Terms that would impose severe time restrictions (e.g. compressibility effects) are evaluated implicitly while other terms are expressed in an explicit manner. The convection effects are solved using a conserving upwind finite difference formulation. Slip is assumed between the gas and liquid phase and is given by an empirical correlation. Any slip model could be used but the one provided with the program is that given by Orkiszewski, 1967. The friction factor is also given as an empirical correlation as specified by Chisholm, 1973. Again any other correlation could be substituted if desired. The equation of state provided with the program is that of pure water.

COMPUTER - CDC7600

OPERATING SYSTEMS - SCOPE 2.1.5

PROGRAMMING LANGUAGES - FORTRAN IV

SOFTWARE LIMITATIONS - Maxima of 200 nodal points and 25 grid points.

SOURCE CODE AVAILABLE (Y/N) - Y

UNIQUE FEATURES - Steady state is not assumed. The transient wellbore code has been coupled with a single-phase radial flow reservoir

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UNIQUE FEATURES -(CONT) model. One can essentially eliminate the behavior of the fluid in the well as an unknown so that the actual reservoir flow can be determined even when wellbore storage is important. By knowing the actual reservoir flow, one can determine reservoir properties by using a multi-rate well test analysis. It may not be necessary to wait until wellbore storage is over. During this early time of a well test, a steady-state model of the flow in the well is not appropriate because a steady-state model assumes that mass into the well equals the mass out of the well. Also, one can solve the flow into the well during a complete shut in to determine the effects of phase redistribution which is not possible with a steady-state model.

RELATED SOFTWARE - WELBORE is one of a set of five geothermal codes. The others are: ANALYZE for multiwell, multirate welltest parameter determination; CCC for one-phase conduction, convection, and compaction; SHAFT79 for two-phase geothermal reservoir simulation; and TERZAGI for isothermal fluid flow and subsidence.

HARDWARE REQS - 55,000 (octal) words of SCM storage

TIME REQUIREMENTS - The sample problem requires about 27 CP seconds on a CDC7600 and 50 CP seconds on a CDC CYBER175 for execution.

REFERENCES - Constance W. Miller, WELBORE User's Manual, LBL-10910, January 1980; National Energy Software Center Note 82-49, WELBORE, NESC No. 895.7600B, WELBORE Sample Problem Output.

ABSTRACT STATUS - Abstract first distributed December 1980. CDC7600 version submitted May 1980, replaced by revised Edition B May 1982, sample problem executed by NESC March 1982 on a CDC CYBER175.

SUBJECT CLASS CODE - HR

KEYWORDS -
W CODES
TRANSIENTS
NAVIER-STOKES EQUATIONS
WELLS
COMPUTERIZED SIMULATION
COMPUTER PROGRAM DOCUMENTATION
FLUID FLOW
TWO-PHASE FLOW
HEAT LOSSES
DIFFUSION

EDB SUBJECT CATEGORIES -
990200 580000 420400

SPONSOR - DOE/CE

PACKAGE TYPE - AS - IS