Contribution ID: **64** Type: **Poster (+) Presentation**

Pore Pressure Sensitivity-Permeability Decay Evaluation for Nonlinear Oil Flow in Porous Media through Green's Functions (GF's)

Wednesday, 2 June 2021 10:00 (1 hour)

The unsteady nonlinear oil flow in porous media makes hydraulic diffusivity equation (HDE) harder to solve analytically and numerically. This work proposes a porous media formation damage evaluation caused by the permeability decay as function of pore pressure. To evaluate this phenomenon, a new integro-differential analytical model using Green's functions (GF's) is proposed to solve nonlinear hydraulic diffusivity equation (NHDE) for radial oil flow with source term. Model considers the change in the properties of the rock and the fluid present inside reservoir rock pores in respect to pore pressure. Normally, dimensionless wellbore solution PwD(tD) for slightly compressible flow of liquids in cylindrical coordinates is solved using the Laplace transform or Boltzmann transformation, obtaining an unsteady pressure profile described by the exponential integral function Ei(rD,tD). Authors also implement the new model in Matlab® software in order to evaluate general solution, so as initial and boundary conditions. The model calibration is performed by comparing the solution obtained for pore pressure-dependent permeability with the solution through a porous media flow simulator and permeability functions for some types of reservoir rock are built through laboratory correlations, generated from synthetic field data. Authors conclude that general solution of NHDE is given by the sum of line-source solution PwD(tD) and the first order term of the series asymptotic expansion, mwD(1)(tD). This second term of the series expansion is obtained by solving a Volterra's second kind integro-differential equation in Matlab and is responsible for all the nonlinearities of the flow. Results of the pressure graphs showed excellent agreement when compared to a numerical simulator and presented errors less than 0.5%.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

Acceptance of Terms and Conditions

Click here to agree

Newsletter

Student Poster Award

Yes, I would like to enter this submission into the student poster award

Primary author: Dr FERNANDES, Fernando Bastos (Pontifical Catholic University of Rio de Janeiro - (PUC-Rio))

Presenter: Dr FERNANDES, Fernando Bastos (Pontifical Catholic University of Rio de Janeiro - (PUC-Rio))

Session Classification: Poster +

Track Classification: (MS12) Advances in modeling and simulation of poromechanics