Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

A model to determine the petroleum pressure in a well using fractional differential equations BEATRIZ BRITO MARTINEZ, FERNANDO BRAMBILA PAZ, Facultad de Ciencias, Universidad Nacional Autonoma de Mexico, CARLOS FUENTES RUIZ, Instituto Mexicano de Tecnologia del Agua — A noninvasive method was used to determine the pressure of petroleum leaving a well. The mathematical model is based on nonlinear fractional differential equations. This model comes from the fractal dimension of the porous medium. The problem is solved in three stages. In the first stage the fractal dimension of the porous medium is determined. We show that microwaves reflected and transmitted through soil have a fractal dimension which is correlated with the fractal dimension of the porous medium. The fractal signature of microwave scattering correlates with certain physical and mechanical properties of soils (porosity, permeability, conductivity, etc.). In the second stage we use three partial fractional equations as a mathematical model to study the diffusion inside the porous medium. In this model sub-diffusive phenomenon occurs if fractal derivative is between zero and one and supra-diffusive occurs if the derivative is greater than 1 and less than 2. Finally in the third stage the mathematical model is used to determinate the petroleum pressure output in a Mexican oil field, which contains three partial fractional equations with triple porosity and permeability.

Beatriz Brito Martinez
Facultad de Ciencias, Universidad Nacional Autonoma de Mexico

Date submitted: 01 Aug 2016 Electronic form version 1.4