A NEW MODEL FOR ESTIMATING THE NON-DARCY FLOW COEFFICIENT USING GENETIC PROGRAMMING

By

ASHRAF MOHAMED IBRAHIM ABD EL MAJEED

A Thesis submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
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in
Gas Production Engineering

Gas Production Engineering Program
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FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis: **A NEW MODEL FOR ESTIMATING THE NON-DARCY FLOW COEFFICIENT USING GENETIC PROGRAMMING**

Key Words: Turbulence flow; Gas Reservoir; Forchheimer; Multi-rate test; Artificial Intelligence; Genetic Programming

Summary:

The researcher studied the development of a new model to predict the non-Darcy flow coefficient with high accuracy compared to the commonly used correlations. This is a major source of rate dependent pseudo skin around wellbore. The researcher built the new model using genetic programming. Where the input of the new model is the permeability and viscosity of the gas and the output is the non-Darcy flow coefficient. The new model was built using 450 points for the Beta Coefficient (Turbulence Coefficient) obtained from multi-rate wells tests. This data is divided into two groups. The first group, consisting of 298 points, was used to construct the new model. The second group, consisting of 152 points, was used to test the new model.

The results indicate that the new model is suitable for estimating the non-Darcy flow Coefficient more accurately than other commonly used empirical correlations and to obtain more reliable inflow performance relationships.

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I am speechless to express my gratitude towards my legendary father (May his soul rest in peace) for his everlasting enthusiasm and support. I cannot ignore my mother's endless efforts to make my dreams come true and enforce self-confidence deep inside me. Last but not least, I would like to thank my wife for being there for me.

Ashraf Mohammed Showman, May 2018

Dedication

I am dedicating this thesis to the most inspiring persons in my life; my dear mother, my lovely wife, my little angel Zain El-Din and my brother and sister and above all my role model; my father.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Date:

Signature:

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