بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

@ ASUNET

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

Cairo University

MULTIPHASE WELL TESTING IN BOUNDED RESERVOIRS

By

Mostafa Reda Sanad

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
INTERDISCIPLINARY - MASTER OF SCIENCE
in
GAS PRODUCTION ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

MULTIPHASE WELL TESTING IN BOUNDED RESERVOIRS

By

Mostafa Reda Sanad

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
INTERDISCIPLINARY - MASTER OF SCIENCE
in
GAS PRODUCTION ENGINEERING

Under the Supervision of

Prof. Ahmed Hamdy El-Banbi
………………………………..
Professor of Petroleum Engineering
Petroleum Engineering
American University in Cairo
(AUC)

Prof. Eissa Mohamed Shokier
………………………………..
Professor of Petroleum Engineering
Petroleum Engineering
Faculty of Engineering
Cairo University

Prof. El-Sayed Ahmed El-Tayeb
……………………………….
Professor of Petroleum Engineering
Petroleum Engineering
Faculty of Engineering
Cairo University

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

MULTIPHASE WELL TESTING IN BOUNDED RESERVOIRS

By
Mostafa Reda Sanad

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
INTERDISCIPLINARY - MASTER OF SCIENCE
in
GAS PRODUCTION ENGINEERING

Approved by the
Examining Committee

____
Prof. Dr. El-Sayed Ahmed El-Tayeb, Thesis Main Advisor

____
Prof. Dr. Ahmed Hamdy El-Banbi, Advisor
American University in Cairo

____
Prof. Dr. Mohamed Helmy Sayyouh, Internal Examiner

____
Eng. Sherif Hassan Haddara, External Examiner
Former Minister of Petroleum and Mineral Resources

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

Engineer's Name: Mostafa Reda Sanad
Date of Birth: 24/8/1990
Nationality: Egyptian
E-mail: mos.rsanad@gmail.com
Phone: 01220126502
Address: Madinaty 14-51-1
Registration Date: 1 / 3 / 2013
Awarding Date: 2021/ /
Degree: Interdisciplinary -Master of Science
Department: Gas Production Engineering

Supervisors:

Prof. El-Sayed Ahmed El-Tayeb
Prof. Ahmed Hamdy El-Banbi
Prof. Eissa Mohamed Shokier

Examiners:

Prof. El-Sayed Ahmed El-Tayeb (Thesis main advisor)
Prof. Ahmed Hamdy El-Banbi (Advisor)
(American University in Cairo)
Prof. Mohamed Helmy Sayyouh (Internal examiner)
Eng. Sherif Hassan Haddara (External examiner)
(Former Minister of Petroleum and Mineral Resources)

Title of Thesis:

Multiphase Well Testing in Bounded Reservoirs

Key Words:
Multiphase; Bounded Reservoirs; Agarwal; Fraim; Pseudo-time

Summary:

Well testing in gas and multi-phase (Volatile oil & Gas condensate) reservoirs cannot be analyzed in the same way of oil reservoirs as the gas properties and phases saturations and properties are functions of reservoir pressure. using pseudo-time and pseudo-pressure functions for gas and multiphase systems considers the properties variation and gives an equivalent incompressible fluid behavior. This is a comprehensive study of applying different types of time functions (**Real time, Agarwal pseudo-time** and **Fraim pseudo-time**) on dry gas and multiphase systems to conclude guidelines to help to determine the most suitable time function that gives most accurate value of certain well test parameter under certain reservoir boundary condition for both of dry gas and multiphase systems.

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: Mostafa Reda Sanad Date: / /2021

Signature

Dedication

I must express my gratitude to my parents who were always there for me, you were always the support and the power, thank you for being in my life.

I would like to thank my small family, thank you my wife, my beautiful daughter and my little son, thank you for everything. Thanks to my brother and sisters and their partners, you were always the model who pushed me to do more to follow your success.

Acknowledgments

I want to thank my supervision committee for their guidance and support. Thanks to Prof. Ahmed El-Banbi for his consistent guidance and for the time he gave to bring this work into success. I would like to thank Prof. Sayed El-Tayeb for paving the way for the completion of this long work. And thanks to Prof. Eissa Shokier for his permanent cooperation and support.

I must express my gratitude to Prof. Mahmoud Tantawy and Eng. Mohsen El-Beltagi who helped me in understanding reservoir simulation.

I would like to thank KAPPA Petroleum Software Company who supported me by Saphir software license to be able to do my research work.

I would like to thank the reservoir team in EGAS who supported me in all my steps.

Thanks to my friend Eng. Omar Yasser who told me that a challenge you did not finish is a failure you would never forget.

Table of Contents

List of Tables

Table No. **Title** **Page**