

Mona Maghraby



# بسم الله الرحمن الرحيم

مركز الشبكات وتكنولوجيا المعلومات

قسم التوثيق الإلكتروني



Mona Maghraby



# جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

## قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها  
على هذه الأقراص المدمجة قد أعدت دون أية تغييرات





Cairo University

# **EFFECT OF DRILLING FLUID TEMPERATURE ON FORMATION FRACTURE PRESSURE GRADIENT**

By

**Ahmed Mostafa Mokbel Ahmed Samak**

A Thesis Submitted to the  
Faculty of Engineering at Cairo University  
in Partial Fulfillment of the  
Requirements for the Degree of  
**MASTER OF SCIENCE**  
in  
**Petroleum Engineering**

FACULTY OF ENGINEERING, CAIRO UNIVERSITY

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Under the Supervision of

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Title of Thesis:

Effect of Drilling Fluid Temperature on Formation Fracture Pressure Gradient.

Key Words:

Temperature Distribution, Thermal Effect, Wellbore Stability, Fracture Gradient.

Summary:

In this thesis, in order to predict the formation fracture gradient in high-temperature formations, a simulation model of the temperature field around the borehole during circulation is established. The effect of temperature change on the formation fracture pressure gradient around the borehole is analyzed and simulated. This effect will be important for HPHT and deep-water wells to reduce the possibility of losses, predict the apparent kick and then save rig time.

# **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: Ahmed Mostafa Mokbel Ahmed Samak

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# DEDICATION

I feel that no one worth this dedication but my parents.

## **ACKNOWLEDGEMENT**

I thank Allah the Almighty for giving me the power and patience to complete this research. I would also like to thank my parents for encouraging and supporting me throughout my life and especially during working on my research. I want to express my great appreciation to Dr. Abdel-Alim Hashem for his valuable and constructive suggestions during this research work.

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# NOMENCLATURES

$A_a$	:	Cross-sectional area of inside of the annulus, $\text{ft}^2$ .
$A_p$	:	Cross-sectional area of inside of the drill-pipe, $\text{ft}^2$ .
APL	:	Annular pressure loss, psi.
B	:	Skempton's pore pressure coefficient.
BG	:	Background gas.
BPH	:	Barrel per hour.
$C_f$	:	Specific heat of formation, $\text{BTU}/(\text{lb.}^\circ\text{F})$ .
$C_m$	:	Specific heat of drilling fluid, $\text{BTU}/(\text{lb.}^\circ\text{F})$ .
CHTC	:	Convective heat transfer coefficients.
D	:	Diameter, in.
DHCT	:	Downhole circulating temperature.
DPL	:	Drill-pipe pressure loss, psi.
$d_e$	:	Equivalent diameter of a flow channel, in.
$d_h$	:	Hole diameter, in.
$d_{pi}$	:	Drill-pipe inside diameter, in.
$d_{po}$	:	Drill-pipe outside diameter, in.
E	:	Young's Modulus.
EMW	:	Equivalent mud weight.
ERD	:	Extended reach drilling.
FG	:	Fracture gradient, (PPG).
G	:	Shear modulus, psi.
gpm	:	Gallon per minute.
H	:	Well depth TVD, ft.
$H_m$	:	Well measured depth, ft.
HPHT	:	High pressure high temperature.
$h_a$	:	Coefficient of heat transfer of fluid in annulus, $\text{BTU}/\text{day.ft}^2\text{-}^\circ\text{F}$ .
$h_p$	:	Coefficient of heat transfer of fluid in drill-pipe, $\text{BTU}/\text{day.ft}^2\text{-}^\circ\text{F}$ .
k	:	Consistency index.
$k_p$	:	Thermal conductivity of drill-pipe, $\text{BTU}/\text{ft.}^\circ\text{F.hr}$ .
$k_f$	:	Thermal conductivity of formation, $\text{BTU}/\text{ft.}^\circ\text{F.hr}$ .