A NEW APPROACH FOR PREDICTING DRILLSTRING VIBRATION IMPACT ON WELLBORE STABILITY

By

Mohamed Shafik Abd-ElAlim Khaled
B.sc. in Petroleum Engineering

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
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MASTER OF SCIENCE
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Under the Supervision of

Prof. Dr. Eissa Mohamed Shokir

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Title of Thesis:

A New Approach for Predicting Drillstring Vibration Impact on Wellbore Stability.

Key Words:

Wellbore stability; drillstring vibration; Well Guard model; rock fatigue; drillstring shocks.

Summary:

Many studies assumed that wellbore instability issues were due to physical and chemical interactions between rocks and drilling fluids. However impact of drillstring vibration on wellbore stability was neglected. This work focus on: a- determining type of vibration mechanisms and major factors lead to drillstring shocks on wellbore wall; b- studying different rock failure mechanisms and computing drillstring vibration limits that can harm wellbore. Investigation results in a clear correlation between whirl vibration and initiation of lateral shocks on wellbore wall. Drill collar length and drillstring revolutions per minutes (RPM) are the major factor of developing these shocks. Drillstring vibration can collapse wellbore by three failure mechanisms: rock compressive failure, rock fatigue, and reduction in rock strength. Authors developed a new model to predict hot ranges for drillstring vibration that collapses wellbore that can be used as an early detector for harmful shocks of drillstring vibration on wellbore stability.

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Last and not least, I would like to express my deepest gratitude to my father Shafik, mother Faten, and wife Sarah for their support and motivation during Master thesis journey.

Dedication

I would like to dedicate this work to God Allah, I hope Allah accept this work. I confirm and confess that any good work done in this thesis is due to Allah help, and any mistakes done in this study are from me.

Table of Contents

ACKNOWLEDGMENTS ..... **I**

DEDICATION ..... **II**

TABLE OF CONTENTS ..... **III**

LIST OF TABLES ..... **V**

LIST OF FIGURES ..... **VII**

NOMENCLATURE ..... **VIII**

ABSTRACT ..... **IXX**

CHAPTER 1 : INTRODUCTION **10**

CHAPTER 2 : LITERATURE REVIEW **11**

2.1. INTORDUCTION OF PETROLEUM ROCK MECHANICS PRINCIPLES 11

2.1.1. Types of Rock Failure 12

2.1.1.1. Mohr-Coloumb Criterion 13

2.1.1.2. Hoek - Brown Criterion 14

2.1.1.3. Modified Lade Criterion 14

2.1.1.4. Modified Wiebols - Cook Criterion 15

2.1.1.5. Drucker - Prager Criterion 16

2.2. WELLBORE STABILITY 16

2.3. ROCK FATIGUE THEORY 19

2.4. DRILLSTRING VIBRATIONS 20

2.4.1. Introduction 20

2.4.2. Vibration Mechanisms 20

2.4.2.1. Drillstring Lateral Shocks due to Whirl (lateral) Vibration 21

2.4.2.2. Drillstring Whirl Vibration Modeling 21

2.5. NUMERICAL METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS 23

2.5.1. Euler Method 24

2.5.2. Heunn's Method 24

2.5.3. Mid Point Method 24

2.5.4. Runga – Kutta Method 24

CHAPTER 3 : STATEMENT OF THE PROBLEM **26**

3.1. SIGNIFICANCE OF WORK 26

3.2. OBJECTIVES 26

3.3. METHODOLOGY 27

CHAPTER 4 : STUDYING MAJOR REASONS THAT LEADS TO DRILLSTRING SHOCKS ON WELLBORE **28**

4.1. INVESTIGATION OF DOMINANT FACTORS THAT LEAD TO DRILLSTRING COLLISION ON WELLBORE WALL 28

4.2. DEFAULT CASE 30

CHAPTER 5 : DISCUSSIONS AND RESULTS……...32

5.1. CHANGING DRILL COLLAR OD……..32
5.2. CHANGING DRILL COLLAR LENGTH……38
5.3. EFFECT OF DRILL COLLAR RPM……41
5.4. EFFECT OF WELLBORE INCLINATION……..50
5.5. EFFECT OF MUD WEIGHT……53
5.6. DISCUSSIONS……55

CHAPTER 6: WELL-GUARD MODEL……...……57

6.1. ROCK FAILURE MECHANISMS DUE TO DRILLSTRING SHOCKS ON WELLBORE…..57
6.2. WELL-GUARD ASSUMPTIONS……58
6.3. WELL-GUARD METHODOLOGY……59
6.4. WELL GUARD EXAMPLE..……...……...60
6.4.1 Input Data……..……60
6.4.2. Output..……...……..…60

CONCLUSIONS……...63

REFERENCES……..64

List of Tables

Table 3.1: Effect of drillstring RPM on collar radial displacement 46
Table 6.1: Well Guard example - input data 60
Table 6.2: Results of Well-Guard example 61