CHAPTER I
INTRODUCTION

Wireline formation testing (WFT) is an alternative technique to provide cost-effective information from reservoir such as formation pressure, fluid gradient, formation fluid samples, fluid contact, and an estimation of near wellbore permeability without disturbing the reservoir pressure. Wireline formation tester has been deployed to collect formation fluid samples and to measure formation pressure at discrete depths along a wellbore since 1950. The wireline formation pressure measurement is acquired by inserting a probe into the borehole wall and withdrawing a small amount of formation fluid and then waiting for pressure to build up to the formation pore pressure. This measurement can provide formation pressures along the borehole. Pressure transient data are measured during this period, and the data can be analyzed using Pressure Transient Analysis technique (PTA). Pressure transient data obtained from WFT can give more detailed reservoir information such as spherical permeability or vertical to horizontal permeability ratio, which provide more accurate reservoir permeability because it considers reservoir anisotropy (Whittle *et* al, 2003) and reservoir heterogeneity behavior (Daungkaew *et* al, 2004). However, WFT still give low radius of investigation, r_{inv}.

However, one of the remaining challenges to understand pressure transient behavior for WFT is the invaded zone around the well which occurs while drilling. Some of the drilling mud can leak into the formation when the well is drilled, generating an invaded zone around the wellbore. Conventionally, this invaded zone is quantified as reducing in the permeability (Gok *et* al, 2003) and skin effect. Skin can affect the pressure transients obtained from formation testers.

This thesis is to study and evaluate the effect of an invaded zone and stimulated zone on pressure transient to obtain reservoir parameters from wireline formation tester. Pressure Transient Analysis (PTA) is used to estimate the reservoir parameters such as permeability and skin factor. Then, we compare the interpreted results with the simulation input.

1.1 Methodology

1. Gather and prepare data for simulation model.
2. Use simulator ECLIPSE100 simulated pressure responses for single well model in a single layer reservoir for a base case (with oil) to confirm numerical solution with analytical solution.
3. Analyze pressure responses for base case using Weltest200 and Saphir well test interpretation software.
4. Simulate pressure responses for a single layered reservoir to investigate the effects of probe size and permeability anisotropy ratio.
5. Analyze pressure responses for a single layered reservoirs with different probe size and permeability anisotropy ratio by using Weltest200 and Saphir well test interpretation software
6. Simulate pressure responses for a single layer reservoir with additional of invaded zone to investigate the effects of mobility ratio and radius of invasion.
7. Analyze pressure responses for a single layered reservoirs with additional of invaded zone with different mobility ratio and radius of invasion by using Weltest200 and Saphir well test interpretation software
8. Simulate pressure responses for a single layer reservoir with additional of stimulated zone to investigate the effects of mobility ratio and radius of stimulated zone.
9. Analyze pressure responses for a single layered reservoirs with additional of stimulated zone with different mobility ratio and radius of radius of stimulated zone by using Weltest200 and Saphir well test interpretation software
10. Compare results obtained from simulated model with input value to justify if the results from wireline formation test model provide the satisfying information.

1.2 Thesis Outline

This thesis paper consists of nine chapters and the outlines of each chapter are listed below.

Chapter II reviews literatures that mentioned development on wireline formation test and mud invasion effect and previous works that have been conducted.

Chapter III describes theory and concepts related to this study.

Chapter IV shows simulation grid model used in this study.

Chapter V examines the simulation studies of a single layer homogeneous reservoir in order to investigate the effects of probe size and effects of permeability anisotropy.

Chapter VI examines the simulation studies of a single layer reservoir with invaded zone in order to study the effects of mobility ratio and effects of radius of invasion.

Chapter VII examines the simulation studies of a single layer reservoir with stimulated zone in order to investigate the effects of mobility ratio and the effects of radius of stimulated zone.

Chapter VIII provides conclusions of the study and recommendations further study based on this study point of view.