

CHAPTER III METHODOLOGY

3.1 Materials

3.1.1 Equipment

This research used a computer laptop model: Intel(R) Core(TM) i7-4500U at CPU 1.86 GHz, RAM: 4 GB and 32-bit operating system to analyze downhole pressure and develop software.

3.1.2 Software

The well description data were input to the developed software by the graphic user interface (GUI). The GUI was an engineering tool enabling the user to correct input data, as well as being an analysis tool for an output data from a software processing via MATLAB R2013a.

3.2 Research Procedures

3.2.1 Literature Survey

3.2.1.1 Drilling Operation

There were many different drilling methods depending on the surface and subsurface location and their condition. The general drilling methods were conventional drilling and underbalanced drilling, but the conventional drilling was considered in this research due to the limitation of data obtained from cooperating company. The fundamental concepts of drilling operation were studied. Bottomhole pressure calculation in operation of running circulating pump and pump off was investigated in both mechanical and empirical models.

3.2.1.2 Mathematical Models

The drilling operation consisted of several activities such as hole cleaning, pipe connection and also drilling activities. This research focused on only drilling activities, thus downhole pressure calculation was only considered in

drilling activities only. Since downhole pressure consisted of hydrostatic pressure and frictional annular pressure loss, several predictive models of frictional annular pressure loss were studied. Predictive models were selected from several published literatures which was developed by using experimental data and field measurements. Pipe rotation effect was also considered in this calculation to simulate real-time pressure profile in wellbore.

3.2.2 Calculation Stage

3.2.2.1 *Parameters Involving in Calculation*

Described the characteristic of formation pressure and its critical condition: pore pressure and fracture pressure. Studied the characteristic of drilling mud and its properties such as density, plastic viscosity and yield point. Well geometry and well description such as a hole size, bit program, casing program with inner casing diameter, and drilling mud program were used in downhole pressure calculation. In addition, effect of pipe rotation was also considered to predict downhole pressure with and without rotational effect.

3.2.2.2 *Boundary Condition of Fluid Flow Model*

Using single phase flow model, the boundary conditions were assumed on the continuous flow of power law model depending on fluid types either in laminar regime or turbulent regime. The effect of rotating pipe on downhole pressure loss or ECD were also involved in this research in order to set the condition as realistic as possible.

Drilling fluid properties, well geometry and well description from field measurements were used in selected predictive models to estimate downhole pressure in term of ECD considering pipe rotation.

3.2.3 Model Verification

Verified the output with the actual depleted well information from Pan Orient Energy (Siam) Ltd using statistical method. Redesigned the calculation what if the results are not acceptable and not precise with the field data.

3.2.4 Software Development

Sequenced the input and output parameters including the step of calculation. Then developed the algorithm to receive the necessary input parameters using MATLAB with GUI to solve predictive model and determine the downhole pressure. This developed software was able to display pressure profile, and designed the display to be more user friendly.

3.2.5 Software Verification

The actual field data at Pan Orient Energy (Siam) Ltd. were in the form of Logging ASCII file type (LAS), which was in either time log or depth log data every 0.25 meters only in drilling operation which containing the drilling parameters. Thus an algorithm was developed to receive LAS file. Then well geometry and well description were input in this software interface to estimate downhole pressure in term of ECD.

3.2.6 Closing Stage

The software is revised and finalized for real-time drilling operation of the next well. The report is summarized.