

## CHAPTER III METHODOLOGY

### 3.1 Materials and Equipment

#### 3.1.1 Equipment

This research used a computer laptop model Intel(R) Core(TM) i5-2410M CPU 2.3 GHz, RAM 4 GB and 64-bit operating system to analyse drilling specific energy, down-hole torque and drag.

#### 3.1.2 Software

This research used MATLAB R2013a with graphic user interface (GUI) to develop software to analyse drilling specific energy, down-hole torque and drag.

### 3.2 Research Procedures

1. Torque and drag were calculated based on Fazaelizadeh, Prurapark and Hareland models.
2. Choose one model for calculating torque and drag in this research.
3. Study the effect of intervals for the calculation.
4. Choose the suitable intervals for research.
5. Apply the results from chosen model for drilling specific energy calculation.
6. Compare and correct the results of drilling specific energy with well logging data and production data from Pan Orient Energy Siam (POES).
7. Modify the program for friendly user that easy to input the data and display output data, which is easy to understand.
8. Write the report and comments the results of the research.

### **3.3 Software Methodology**

#### 3.3.1 Data Preparation by User

The user must prepare all of required data in two Microsoft Excel files. The details of data preparation will discuss in appendix.

#### 3.3.2 Data Preparation by Program

After user run the program and click calculate, the program will read the data from both excel files and calculate the required data in friction and drilling specific energy calculations.

#### 3.3.3 Down-Hole Parameters Calculation

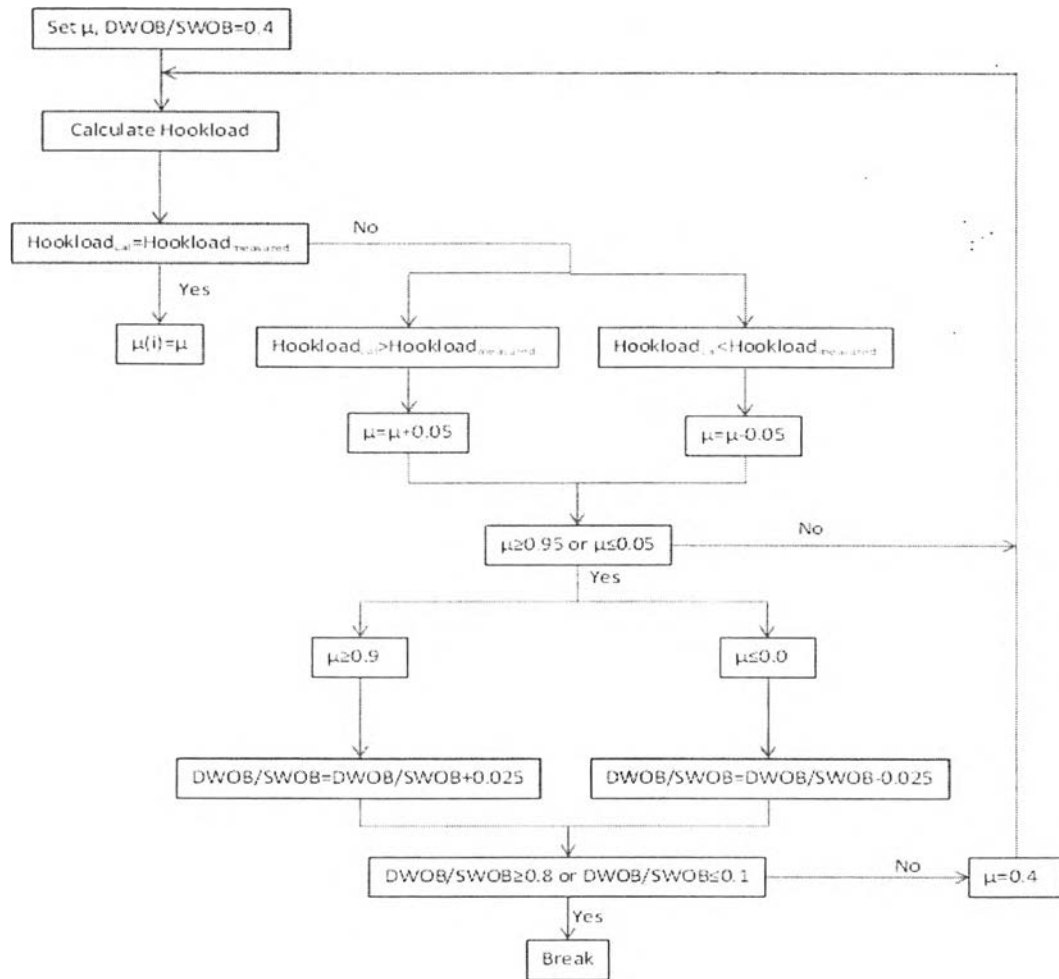
When all required data are prepared, the software will calculate down-hole parameters by using the friction model with back calculation method. The back calculation method is method that will compare the result of calculated hook load with the actual field hook load by vary friction coefficient. The flow chart of back calculation method is shown in Figure 3.1.

#### 3.3.4 Drilling Specific Energy (DSE) Calculation

The DSE will be calculated for the last step. DSE were calculated every two meters. The results of DSE will be plotted in the GUI of program versus measured depth and also zoomed in by input the range of measured depth on GUI.

### **3.4 Interpretation Methodology**

The results from drilling specific energy will be plotted with well logging data, field production data, perforation data and lithology. The well logging data consist of Neutron Porosity (NPRL), Density (RHOB), DT35 (Sonic Log), Resistivity (DDLL and DSLL) and Gamma Ray (GRGC).



**Figure 3.1** The back calculation flow chart.