Chapter 1
Introduction

1.1. General Introduction

1.1.1. Definition of Petroleum

Petroleum (an equivalent term is crude oil) is a complex mixture consisting predominantly of hydrocarbons and containing sulfur, nitrogen oxygen, and helium as minor constituents. The physical and chemical properties of crude oils vary considerably and are dependent on the concentration of the various types of hydrocarbons and minor constituents present.(Tarek Ahmed, 2001)

1.1.2. Importance of PVT Analysis

An accurate description of physical properties of crude oils is of a considerable importance in the fields of both applied and theoretical science and especially in the solution of petroleum reservoir engineering problems.

Engineers typically require accurate estimates of crude oil properties in order to compute oil reserves, production capacity, and recovery efficiency of a reservoir. These properties are also used in the analysis of well test and production data, as well as for production engineering activities such as hydrocarbon system optimization and flow measurement.

The best source of oil property data is a laboratory PVT (pressure-volume-temperature) analysis of a reservoir fluid sample.

Knowledge of the PVT parameters is a requirement for all types of petroleum calculations such as determination of hydrocarbon flowing properties, predicting future performance, designing production facilities and planning methods of enhanced oil recovery. Over the last decade increased attention has been focused on models for predicting reservoir fluid properties from reservoir pressure, temperature, crude oil API gravity and gas gravity. (WILLIAM D.McCAIN1998)

1.1.3. Importance of Bubble Point Pressure

Bubble point pressure is defined as the pressure at which the first gas bubble evolves from liquid phase, thus differentiating between single and multi-phase state of reservoir fluids.

Prediction of bubble point pressure (P_b) is very important in reservoir and production computation.(Tarek Ahmed, 2001)

1.1.4. Importance of Correlations

For the last 60 years, engineers realized the importance of developing and using empirical correlations for PVT properties such as (standing1947), (Glaso1980), (Al-Marhoun1988) (Dokla and Osman 1992), (Hanafy et al.1997)….etc. Studies carried out in this field resulted in the development of new correlations.

There are many empirical correlations for predicting PVT properties, most of them were developed using linear or non-linear multiple regression or graphical techniques.

For developing a correlation, the geological condition must be considered because the chemical composition of crude oil differs from region to region.

When the laboratory PVT data is not available (absence of experimentally measured properties of reservoir fluids) the physical properties of crude oil must be estimated from correlations.

Empirically derived correlations are used to predict the needed properties. All computations, therefore, will depend on the accuracy of the correlations used for predicting the fluid properties.(Elsharkawy, 1998)

1.2. Statement of Problem

As General, Bubble point pressure is determined from laboratory tests on samples collected from separator and the bottom of the wellbore, and due to the high cost, sampling-testing reliability and time consumed for conducting a laboratory test; this situation leads to motivation for developing mathematical bubble point pressure correlations.

1.3. Research Objectives

The main objective of this study is to develop new predictive model for bubble point pressure for Sudan crude oil by using polynomial neural network method (PNN) and evaluate it against the common empirical correlations that can been used in the petroleum industry.

In addition to use MATLAB software for creating guide user interfaces (GUIs) for bubble point pressure evaluation including the new developed model.

PVT data from different oilfields (212 datasets) were used in this research.

1.4. Thesis Outlines

This research is divided into five chapters. *In Chapter1*, general introduction of bubble point definition and their importance, importance of PVT analysis , importance of correlations ,general introduction of polynomial neural network(PNN),statement of problem and the objective of the study were provided .*Chapter 2* contains the theoretical background of bubble point pressure, general definition of artificial neural network (ANN) and some previous studies of bubble point pressure through the world .*Chapter 3* explains the methodology of the common empirical correlations that applied in this study, methodology of developing new model using polynomial neural network (PNN), the statistical analysis for models evaluation and creating guide user interface (GUI) using MATLAB software for bubble point pressure evaluation. The results and discussions are displayed in *Chapter 4*. *Chapter 5* contains conclusion and recommendation.