CHAPTER I

INTRODUCTION

For any hydrocarbon reservoir, the amount of fluid in a reservoir is always needed to be known in order to estimate or predict how long and how much the reservoir can produce. There are many methods to evaluate the amount of fluid in place. A material balance is one method which is widely used. Material balance equations have been developed and modified for several types of reservoir systems.

The material balance equation for a gas reservoir is used to evaluate gas initially in place, GIIP, and reserves. The standard plot of an average reservoir pressure divided by a gas deviation factor (at the average reservoir pressure) versus cumulative gas production, known as a p/z plot, is based on a gas material balance equation. The p/z plot is widely and normally used for a single-layered gas reservoir to evaluate GIIP and reserves because of its easiness in use.

However, the material balance method, hence the p/z plot, has been developed based on the assumption that the existence of the reservoir has no effects on the average-pressure fluid behavior. It would then be beneficial to the petroleum industry if the investigation is carried out to see if the existence and the dimension of various reservoir systems have any effect on the material balance calculation or, to be specific, on the p/z plot. If any effect exists, further investigations are needed to find out how the p/z plot is affected.

In addition to the effect of a single-layered reservoir and its properties (rock and rock-fluid interaction properties), the effects of a multi-layered reservoir and its properties on the p/z plot will be investigated. The results of these investigations can be used to justify or verify the applicability of the p/z plot and to modify the p/z plot technique such that it can be used for a specific reservoir system. This will help a petroleum engineer to be able to use the p/z plot correctly for his specific reservoir system.

Reservoir simulations will be used to simulate various reservoir systems. Then the production data obtained from these reservoir simulations will be used to prepare the p/z plots. From these, the effects of reservoir systems and their properties on the p/z plots can be investigated. Application of the p/z plots to real data will be illustrated.