

## **CHAPTER V**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Conclusions**

The finite-difference method was studied, covering two-dimensional alternating-direction method (IAD) and tridiagonal matrix, applied to solve the problem problems in field of chemical engineering that the general equation is partial differential equation, containing in gas storage problem. To achieve this destination, the program was built by FORTRAN programming language. The program was tested with two problems in heat transfer problem and developed to solve the gas storage problem. The results are accuracy and effectiveness. The precision of the solution depend on the number of grid. If the user uses a lot of grid, the results will take a few errors, but it takes a lot of time to find the solution. The appropriate of solution depend on the way that the user uses the data.

#### **5.2 Recommendations**

Although the alternating-direction method (IAD) is a very effective method to solve many mathematical problems in partial differential equation in fields of chemical engineer, the benefit of its concept is important to develop program, depending on program developers and users. So, the ways to improve abilities of program can be offered as,

1. To develop three-dimensional to make program more useful.
2. To develop the program to solve in multi layer system.
3. To develop the program into graph mode.

For the first improvement, the model should be developed to 3D for the accurate the result that give from the program. For convenient to understand, the program start with 2D that the same as start in this thesis. The governing equation is equation 2.3

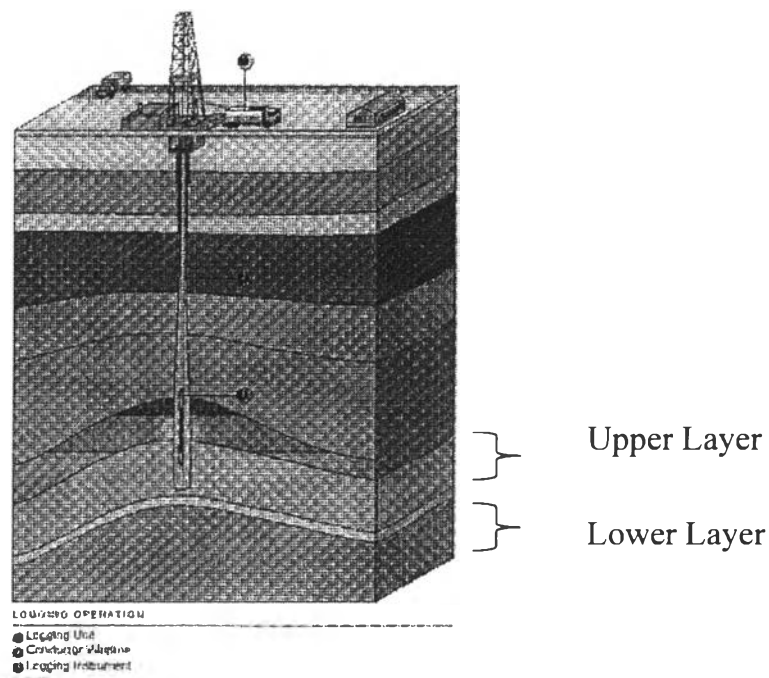
$$\frac{\partial}{\partial x} hk \frac{\partial \Phi}{\partial x} + \frac{\partial}{\partial y} hk \frac{\partial \Phi}{\partial y} - \frac{q_s T p_s}{T_s} = \epsilon h \gamma \frac{\partial \Phi}{\partial t} \quad (2.3)$$

From the equation 2.3, the governing equation rearrange from 2D to 3D, it become

$$\frac{\partial}{\partial x} hk \frac{\partial \Phi}{\partial x} + \frac{\partial}{\partial y} hk \frac{\partial \Phi}{\partial y} + \frac{\partial}{\partial z} hk \frac{\partial \Phi}{\partial z} - \frac{q_s T p_s}{T_s} = \epsilon h \gamma \frac{\partial \Phi}{\partial t} \quad (6.1)$$

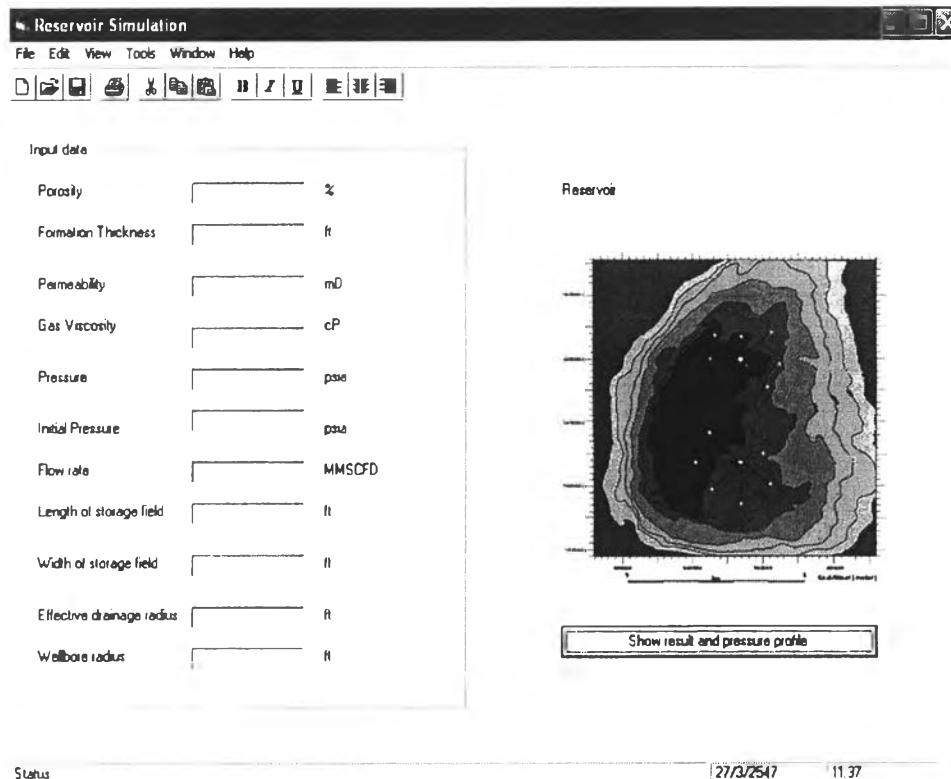
The model of reservoir simulation is shown in 3D that should give the accurate results.

The second improvement is developed the program to solve in multi layer system. This model of reservoir simulation n this thesis is single layer system. If the results are given more accrete, the program will be developed to multi layer system. The results from the lower layer are the initial value from the upper layer.

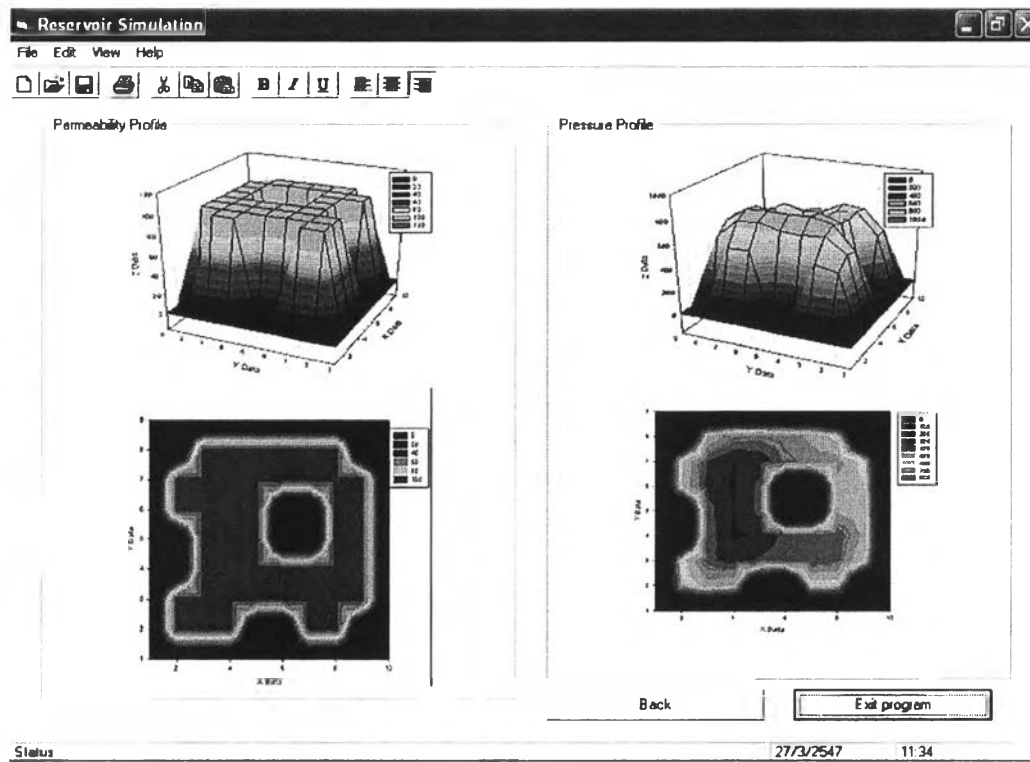


**Figure 5.1** The layer of the reservoir

The last development is developed the program into graph mode. The convenient application or commercial program is the easy program that anyone can use. For example, the program is written by Visual Basic program that are shown in Figure 5.2 and 5.3.



**Figure 5.2** The input data of reservoir simulation.



**Figure 5.3** The results of reservoir simulation.