Analytical versus Numerical Solutions

Analytical: Solve a partial differential eq. with initial and boundary conditions.
- Need solution for each particular problem
- Gives dependence on variables (S, T, etc.)
- Only available for relatively simple problems (homogeneous, simple geometry)
  - Examples: Theis, Theim, Analytical Element Method (AEM)

Numerical: Replace partial derivative with algebraic equation.
- one solution can handle multiple problems
- heterogeneous as well as complex geometry
- some loss in accuracy if large region
- does not give a continuous solution
  - Examples: Finite Difference Method (FDM), Finite Element Method (FEM)

Finite Difference Method
Finite Difference Method

Example: Finite Difference Method
Example: Finite Difference Method

Steady-state 2-D Uniform Flow: Numerical Solution
Spreadsheet Implementation of FDM

Fig. 9.3. Example of the finite difference method.