Atlas

Numerical Techniques

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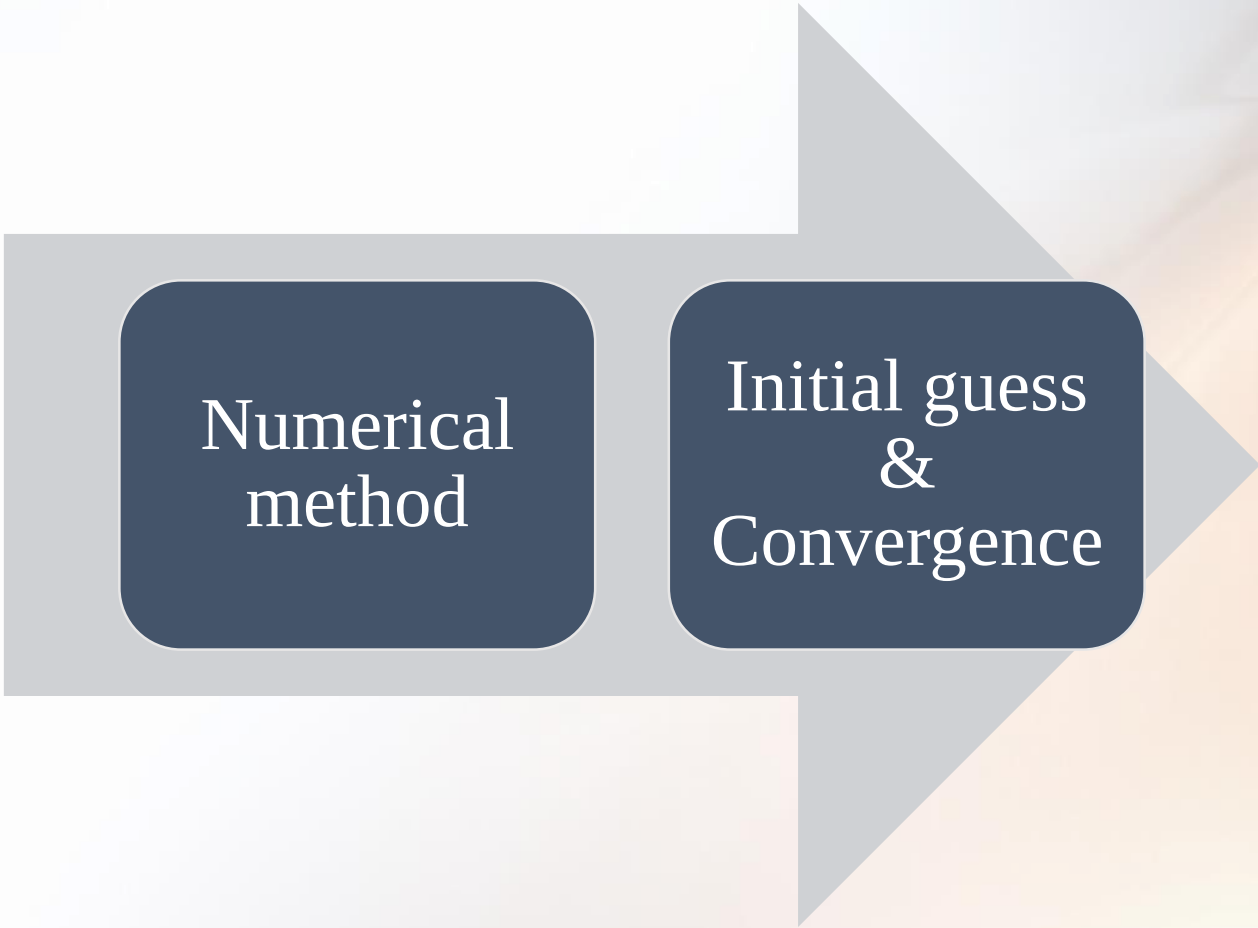

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Numerical Method

a) decoupled (GUMMEL)
b) fully coupled (NEWTON)
c) BLOCK

- The GUMMEL method will solve for each unknown in turn keeping the other variables constant, repeating the process until a stable solution is achieved. The NEWTON method solve the total system of unknowns together. The BLOCK methods will solve some equations fully coupled while others are de-coupled.

Numerical Method

- NEWTON requires a more accurate initial guess. GUMMEL can often provide better initial guesses. Therefore it can be useful to start a solution with a few GUMMEL iterations to generate a better guess. Then, switch to NEWTON to complete the solution. Specification of the solution method is carried out as follows:
- METHOD GUMMEL BLOCK NEWTON

Initial Guess

- When no previous solutions exist, the initial guess for potential and carrier concentrations must be made from the doping profile in zero bias condition. This is specified by the statement:

SOLVE INIT

The First & Second Non-Zero Bias

- The initial guess for any bias point is provided by a projection of the two previous results. If one previous bias is available, it is used alone.
- Since the initial solution is at zero bias, it provides a poor initial guess. Therefore, the first and second non-zero bias solutions should have very small voltage steps.

Convergence

• In the following example, the first case will likely converge whereas the second case may not.

1. SOLVE INIT

SOLVE VDRAIN=0.1

SOLVE VDRAIN=0.2

SOLVE VDRAIN=2.0

2. SOLVE INIT

SOLVE VDRAIN=2.0

Convergence

1. SOLVE VGATE=1.0 VDRAIN=1.0 VSUBSTRATE=-1.0
2. SOLVE VGATE=1.0

   SOLVE VSUBSTRATE=-1.0

   SOLVE VDRAIN=1.0

- The advantage of the second method over the first case is that the small incremental changes in voltage allow for better initial guesses at each step and less convergence problems.

The Trap Parameter

- The simplest and most effective method to overcome poor convergence:

METHOD TRAP

- If the SOLVE statement does not converge, TRAP automatically cuts the bias step in half. This procedure is repeated up to a maximum number of tries set by the METHOD parameter MAXTRAPS (The default is 4).

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http://ucourse.ir/open-courses/silvaco/