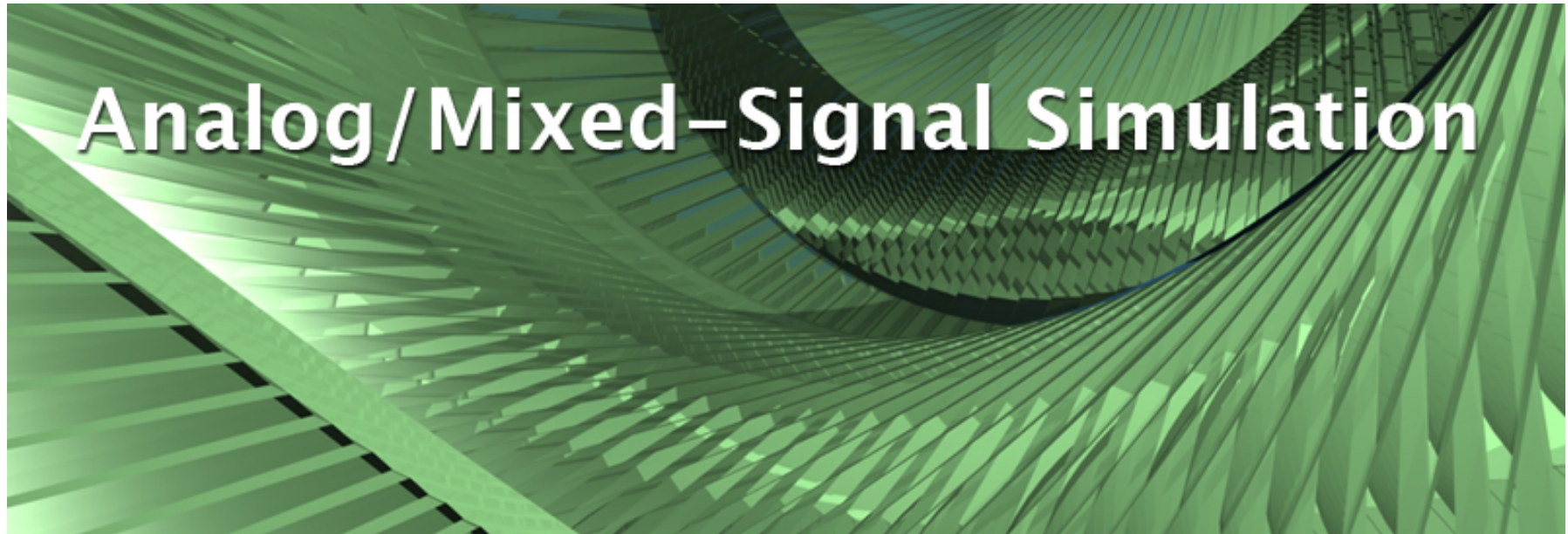


SmartSpice Training Program



Part 3: SmartSpice Convergence Tips



SILVACO

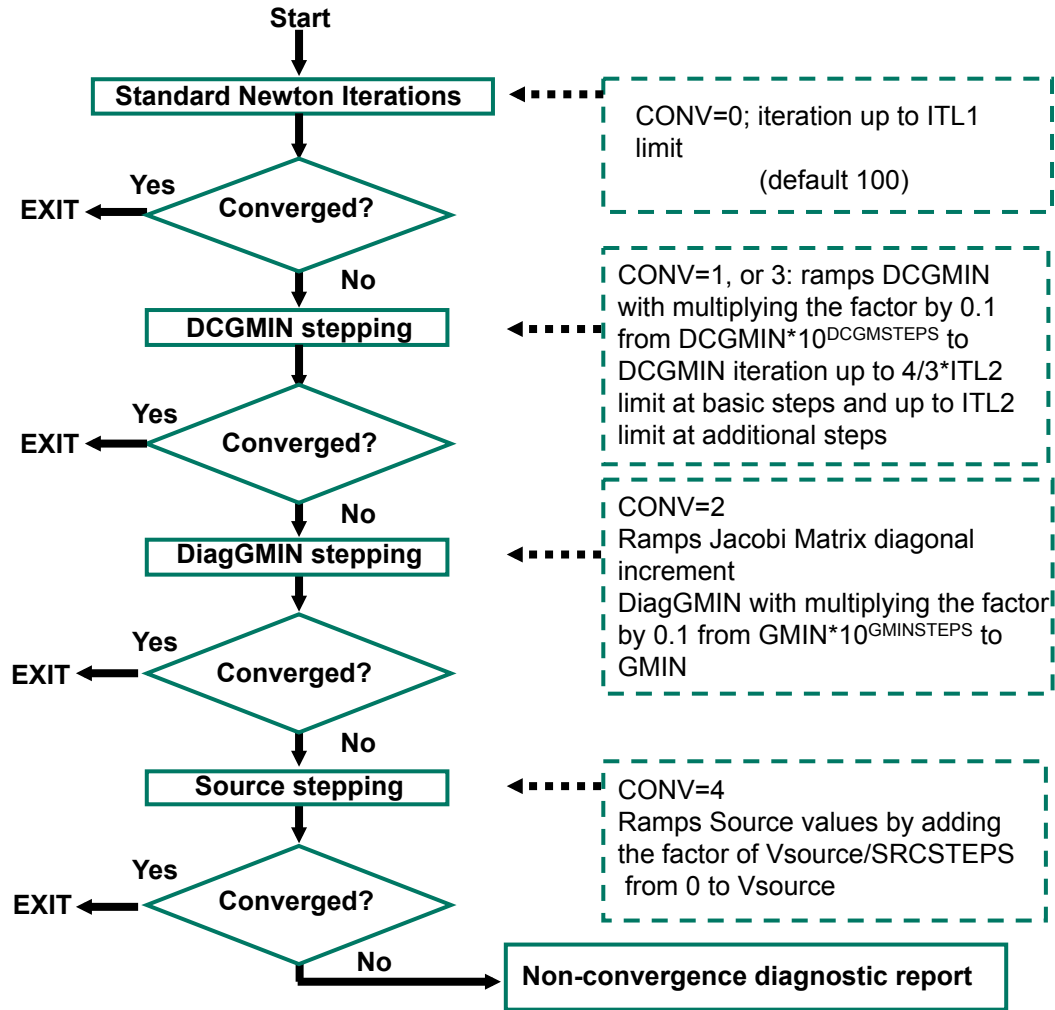
Analog / Mixed-Signal Simulation

Basics to Convergence

- SmartSpice starts with Operating Point Calculations during
 - DC Operating Point & DC Sweep Analyses
 - Transient Analysis without UIC
- SmartSpice constructs system equations and solves them using Newton-Raphson method

Analog / Mixed-Signal Simulation

Auto Convergence Algorithm Process – 5 Levels



Analog / Mixed-Signal Simulation

DC/OP Analysis Convergence Aids

- DCGMIN conductance (1e-12) is placed in all PN junction active devices
- Auto convergence algorithm process –Five levels to achieve good convergence
- Convergence Options
 - ACCEPT
 - CONV
 - DCGMIN
 - DCPATH=
 - EXPERT=777 (779 & 11)
 - GMIN=
 - ITL1=
- Model/Solver-related Option
 - PIVTOL=
- Initial Condition
 - .NODESET, .IC

Analog / Mixed-Signal Simulation

Transient Analysis Options

- Convergence & Options

- `CNODE=1e-8`
- `DCPATH=1`
- `GMIN=`
- `GNODE=`
- `NEWTOL`

- Time-step too small

- `OPTIONSET=3`
- `OPTIONSET=4`

Analog / Mixed-Signal Simulation

Aids in Overcoming Non-Convergence

- Remove all options except `EXPERT=777`, `LIST`, `ACCT`
- Allow SmartSpice auto-convergence to proceed
- Check the diagnostics detail provided by SmartSpice
- Check “Warning” & “Error” message printed from SmartSpice
- Make corrections (circuit topology, node check, unit setting, so on...)
- Run the simulation
- Use Control Options
- During transient analysis, you can try “`TRANOP`” or “`UIC`”
- Re-run the simulation

Analog / Mixed-Signal Simulation

Notes and Restrictions for Using Control Options

Ex: “stopcont” options is not available under batch mode

Ex: “probe” options only be valid with “post”

Ex: Convergence and accuracy options depends on analyses type

Ex: Negative Conductance -- Model related

- `.Options GMINDC=value GMIN=value`
If the `<value>` $> -1e-8$, consult your model provider
- Please refer for more detail to SmartSpice User’s manual
- To achieve “ Higher Accuracy” and overcome the “Non-Convergence” issue, it is highly recommend to run SmartSpice before using any options