The following techniques can be used to solve 90 to 95% of all convergence problems. When a convergence problem is encountered, you should start at solution 0 and proceed with the subsequent suggestions until convergence is achieved. The sequence of the suggestions is structured so that they can be incrementally added to the simulation. The sequence is also defined so that the initial suggestions will be of the most benefit. Note that suggestions which involve simulation options may simply mask the underlying circuit instabilities. Invariably, you will find that once the circuit is properly modeled, many of the "options" fixes will no longer be required!

General Discussion

Many power electronics convergence problems can be solved with two option parameters, Gmin and Rshunt. The Gmin option is available in all SPICE 2 and 3 programs. Gmin is the minimum conductance across all semiconductor junctions. The conductance is used to keep the matrix well conditioned. Its default value is 1E-12mhos. Setting Gmin to a value between 1n and 10n will often solve convergence problems. Setting Gmin to a value which is greater than 10n may cause convergence problems.

The Rshunt option causes IsSPICE to insert a resistor from every node in the circuit to ground. Rshunt is available only in programs such as IsSPICE that have incorporated the XSPICE enhancements [36]. Setting Rshunt to a value between 100MEG and 1G will typically help. Setting Rshunt to a value of 100K may cause convergence problems.

SPICE does not always converge when relaxed tolerances are used. One of the most common problems is the incorrect use of the .Options parameters. For example, setting the tolerance option, Reltol, to a value which is greater than .01 will often cause convergence problems.

The default numerical integration method is the Trapezoidal method. Some circuits will converge better during the transient