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| POWER GRID ANALYSIS IN INTEGRATED CIRCUITS |
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POWER GRID ANALYSIS IN INTEGRATED CIRCUITS

Dr. Ahmed Nader

**Abstract:**

PCB Power integrity (PI) analysis is an essential part of modern electronic design. The ever-increasing numbers of voltages used by ICs, in addition to dramatic increases in power consumption, make the challenges of improving power integrity an exceedingly difficult task. Compounding these challenges is reduced layer counts and finer pitches BGA footprints that perforate copper planes, making it difficult to supply DC voltage and current.

With inadequate power delivery, designs can exhibit seemingly intermittent [signal integrity](http://www.mentor.com/products/pcb-system-design/circuit-simulation/hyperlynx-signal-integrity/) issues, which cause the logic on the board to fail. If power delivery is extremely poor, there can be complete part failure due to inadequate voltage and/or current resulting in a non-functional design.

Hardware engineers, PCB designers, and signal integrity specialists alike can use CAD Tools and generate simulation results to help them to solve the design problems before manufacturing it. CAD Tools enables you to:

* Improve power integrity by identifying power distribution problems early in the design, even prior to layout.
* Detect problems with your design that would be difficult to spot in the lab
* Investigate solutions in an easy-to-use what-if environment.

**CONCLUSION:**

(a) Present complete definition about power grid and how to model it, how to extract the power grid and eliminate it into resistance and current source, modeling the effect of the current source into the power grid, and how to define power delivery network.

(b) Discuss a lot of methods containing the circuit parameter with a little explanation of the scattering parameter and the transmission parameter and their rules in defining the power grid, rule of this parameters in simulating power grid which lead to deduce they will be efficient but not enhance the speed of the simulation (reduce simulation time) with increasing the complexity of the equations.

(c) The fast algorithm methods is presented and give us good results, containing several efficient node-based and row based methods for power grid DC analysis are presented. They capture the geometrical property of power grids. Instead of constructing the system matrix, its computation is based on the local grid structure to save memory resources. Experimental results show that they have both accuracy and runtime advantage over the random walk method.

(d) Applying the node-based method in the simple cell lead to increase the simulation time 25 times greater than the ordinary simulator with almost accurate values of voltage of nodes.

(e) The same for the complex cell and shown in the figures and graphs the efficiency of fusion of the node-based method with the (5 \* 5) algorithm and using sort function lead to increase accuracy with keeping the same speed of the simple cell simulation.

(f) Introduce the improved node-based method and the improve row method which will predict to increase the speed of solving the algorithm which will be point to search in it in the future.

(g) Present tow methods to implement the effect of the parasitic capacitor and transient analysis producing good behavior in dealing with this issue and can be another good point to develop in research.

**Future work:**

* Ground power grids
* Accurate and fast transient analysis