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Direct Finite Element Solver of Linear Complexity

This technology is a highly efficient, direct solver for complex 3D circuit analysis that overcomes computational barriers previously thought impossible for obtaining a system matrix inverse.

As computer processing power increases, higher bandwidths must be analyzed and implemented to take full advantage of this increased computing power. This analysis is normally done through the use of matrix integrations. Unfortunately, as computers have advanced, the complexity of materials used in these circuits, semiconductors in particular, have greatly increased. As a result, the scale of these problems has grown exponentially, and current direct matrix solvers have too high of a computational cost to be effectively used. Instead, most modeling of full-wave analysis for large-scale problems is done using iterative solvers, which also become very inefficient when working with large matrices.

Researchers at Purdue University have developed a fast, direct finite element method (FEM) solver of linear complexity for full wave analysis of general 3D circuits, including those containing arbitrarily shaped semiconductors in inhomogeneous materials. This software is able to take full advantage of the increasing CPU and memory of modern computers to directly obtain the inverse of a system matrix, a computation previously thought to be too complex to attempt. Purdue researchers broke the computational barrier of direct matrix solutions by achieving an optimal complexity, and therefore, provide a modeling technology for circuit analysis with revolutionary performance.

Advantages:

-Highly efficient

-Solves directly

Potential Applications:

-3D circuit analysis

Technology ID

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Category

Robotics & Automation/Simulation, Digital Twins, & Industrial Automation
Semiconductors/IC Design & EDA Tools

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View online

-Complex matrix integration

-Direct FEM solver

TRL: 3

Intellectual Property:

Keywords: Fast direct FEM solver, full wave analysis, 3D circuit analysis, matrix integration, linear complexity, direct matrix solutions, system matrix inverse, arbitrarily shaped semiconductors, inhomogeneous materials, iterative solvers, Circuits, Computer Technology, Linear Algebra, Semiconductors