Parallelization of an Electromagnetic Analysis Tool

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Project Overview

• Increase the capabilities of a WIPL-D, a well-known commercially available electromagnetic modeling tool

• Effort sponsored by the CHSSI initiative under the DOD High Performance Computing Program

• Tri-Service application areas of interest:
  – Detection of Targets Under Trees (FOPEN)
  – Ship Radar Performance
  – Strategic Subsurface Detection
  – Land Mine Imaging
Wipl-D Overview

- **WIPL-D - Wires, Plates, and Dielectrics**
- Electromagnetic modeling tool developed by Dr. Tapan Sarkar of Syracuse University
- Uses bilinear quadrilateral domain technique, reducing number of unknowns for large scale simulation problems
- Desired applications either cannot be run or take an extremely long time on current single processor version

![Image of RCS of Mirage at f = 600 MHz](image.png)
(Number of unknowns used in the analysis is 7760. (The analysis is performed at Pentium 2 with 512 Mb of RAM.)
Parallelization Effort

- Current Parallelization Target Areas
  - Frequency
    - Implemented, provides linear scaled speedup on HPC’s
  - Impedance Matrix Generation
    - Allows for larger number of unknowns
  - Impedance Matrix Solution
    - Currently implemented using Scalapack libraries

- Completed Alpha Test (Frequency Parallelization)
  - Ran with 32 processors on two HPC’s at MHPCC
    - Worst case scaled speedup – 93%
    - Worst case accuracy – 0.08%