

Parallelization of an Electromagnetic Analysis Tool

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Project Overview

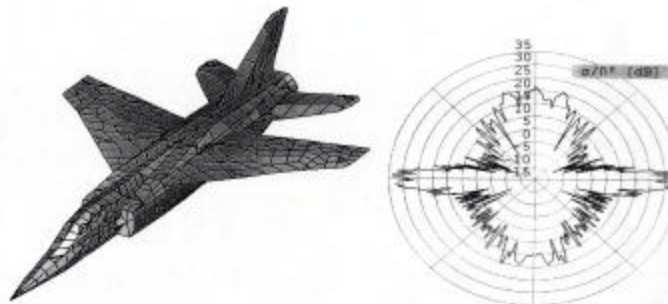
- **Increase the capabilities of a WIPL-D, a well-known commercially available electromagnetic modeling tool**
- **Effort sponsored by the CHSSI initiative under the DOD High Performance Computing Program**
- **Tri-Service application areas of interest:**
 - **Detection of Targets Under Trees (FOPEN)**
 - **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**

RCS of Mirage at $f = 600$ MHz.
(Electrical length of the airplane is about 25 wavelengths.)



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%

