16. ABSTRACT

Parallelization of existing high-order codes have been completed as proposed. The parallel performance of our code is demonstrated in table 1: nearly perfect scaling is observed. Parallelization of other solvers was also achieved during this period, including for example, our high-order penetrable scattering solver. A complete description of the associated methods can be found in Refs. 3-5; the parallel performance of the codes is discussed in detail in reference 4.
Objectives

The objectives of this effort, as stated in the grant proposal, are two-fold:

1. Parallelization of existing high-order surface-scattering codes for acoustic scattering from smooth scatterers.
2. Initial development of the geometry capability, with application to description of smooth and singular surfaces.

Report

Parallelization

Parallelization of existing high-order codes has been completed, as proposed. The parallel performance of our code is demonstrated in Table 1 below: nearly perfect scaling is observed. Parallelization of other solvers was also achieved during this period, including,

<table>
<thead>
<tr>
<th># of processors</th>
<th>Computing time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>792.83</td>
</tr>
<tr>
<td>2</td>
<td>408.89</td>
</tr>
<tr>
<td>4</td>
<td>205.47</td>
</tr>
<tr>
<td>8</td>
<td>105.00</td>
</tr>
<tr>
<td>16</td>
<td>56.01</td>
</tr>
<tr>
<td>32</td>
<td>31.22</td>
</tr>
<tr>
<td>64</td>
<td>17.35</td>
</tr>
</tbody>
</table>

Table 1: Parallel performance of the singular integrator.

for example, our high-order penetrable scattering solver. A complete description of the associated methods can be found in Refs. 3—5; the parallel performance of the codes is discussed in detail in reference 4.

High-order geometry-description

An overall method has been produced which, based on newly introduced methods for high order approximation of non-periodic functions by Fourier series via a continuation approach,
allows to produce highly accurate representation of large portions of air vehicles with very high accuracy. We demonstrate this in Figure 1, which shows the forward portion of an F-15 aircraft. In the figure we thus see the original triangulation (in white), displays of four Fourier series describing portions of the aircraft (bottom), and a display of the these four portions superimposed, producing, in fact, explicit Fourier series representations for the vehicle.

**Personnel Supported**

Dr. R. Paffenroth.

**Publications**


Interactions/Transitions

Participation in a wide range of scientific meetings, interaction with university colleagues and seminars at universities, as well as seminars and consulting work for industrial parties are a regular part of our research efforts. Recent and forthcoming plenary lectures are listed in the section "Honors and awards" below; other meetings, presentations and interactions include work in connection with KLA tencor and JPL, participation in the IPAM workshop on inverse problems in life sciences, participation in the 20th annual review of progresses in applied computational electromagnetics, etc.
Honors/Awards

PI will be/was plenary speaker at the conferences:


- "XIV Congress on Numerical Methods and their Applications" (Bariloche, Argentina.) 8-11 November 2004.

- "7th International Conference on Mathematical and Numerical Aspects of Wave Propagation" (WAVES'05, Brown University, Rhode Island.) June 20-24, 2005.