Parallel Software Design for AVIRIS Project

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Highlights of AVIRIS Software

- ¥ Two major codes: MODTRAN and Nonlinear Least Squares Fitting (NLSF).

- ¥ MODTRAN was developed by the Air Force Phillips Laboratory in 1970 s with about 40,000 lines in Fortran, and NLSF code was designed by the JPL group.

- ¥ Running the entire package is very time consuming if a large data set is encountered.

Object of Present Study

¥ Establish high speed computation for the AVIRIS data processing.

¥ Design a parallel version of software for different parallel platforms.

¥ Apply the software for various scientific applications.

Computing Systems

¥ Original system: *Sun workstation.*

¥ Target systems:

Cray T3D and *T3E* (massively parallel systems)

HP SPP2000 (shared memory parallel system)

Beowulf PC clusters (cheap parallel systems)

Any parallel systems with the MPI software

Problems Encountered

¥ Different compiler gives different error messages.

¥ Binary data conversion on different systems.

¥ Subroutine s names conflict with system s call.

¥ File unit numbers are out of the legal system range.

¥ I/O errors.

¥ Data structure inconsistency.

¥ Some other problems.

Technical Approach

- Testing the entire package on various computing systems.

- Use compiler options to handle some problems.

- Modify codes if necessary.

- Documentation.

Technical Approach

- Domain decomposition with MPI.

- Load balance.

- Parallel and sequential I/O.

- Performance analysis.

- Scripts (easy to use the package on parallel systems).

- Documentation.

Performance Results-Real Time Comparison
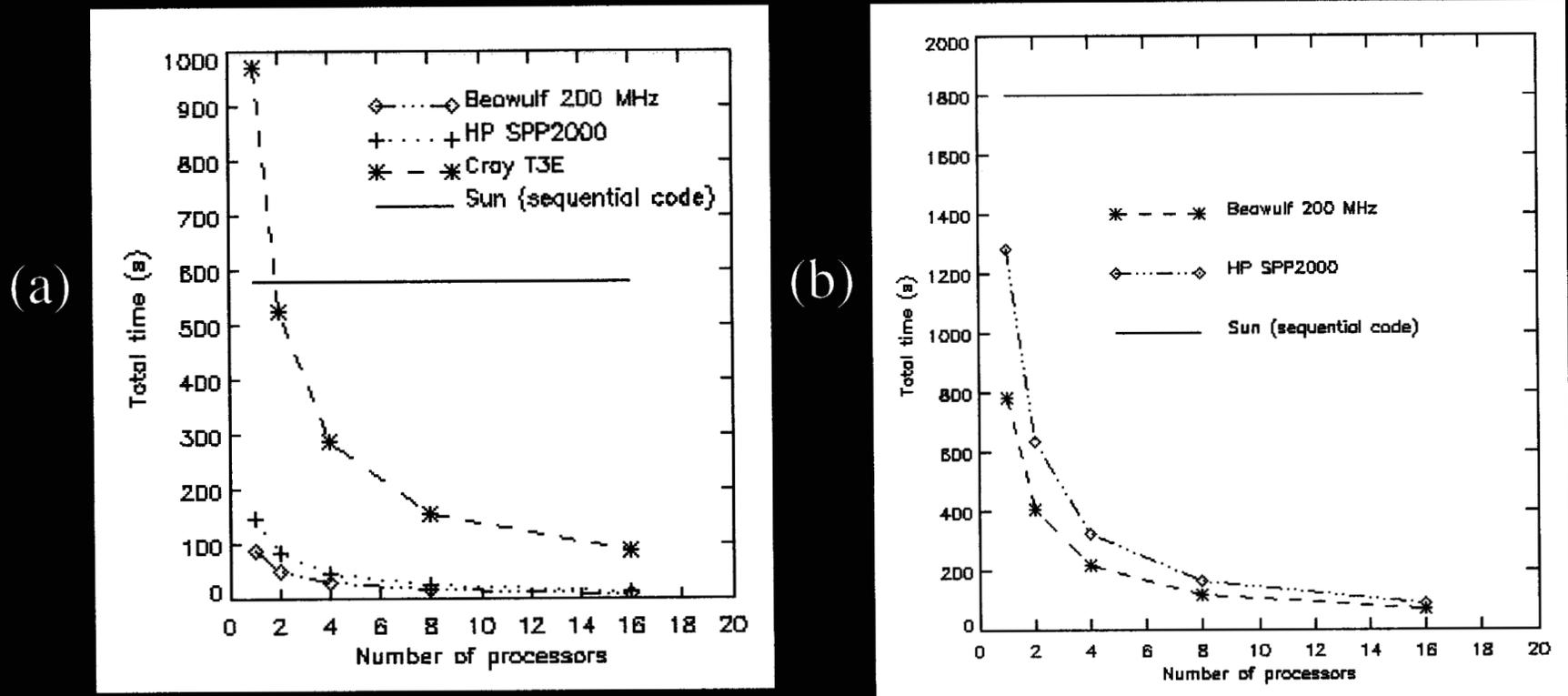

(a)

(b)

Fig1. MODTRN (a) and Nonlinear Least Squares Fitting code (b) on parallel systems
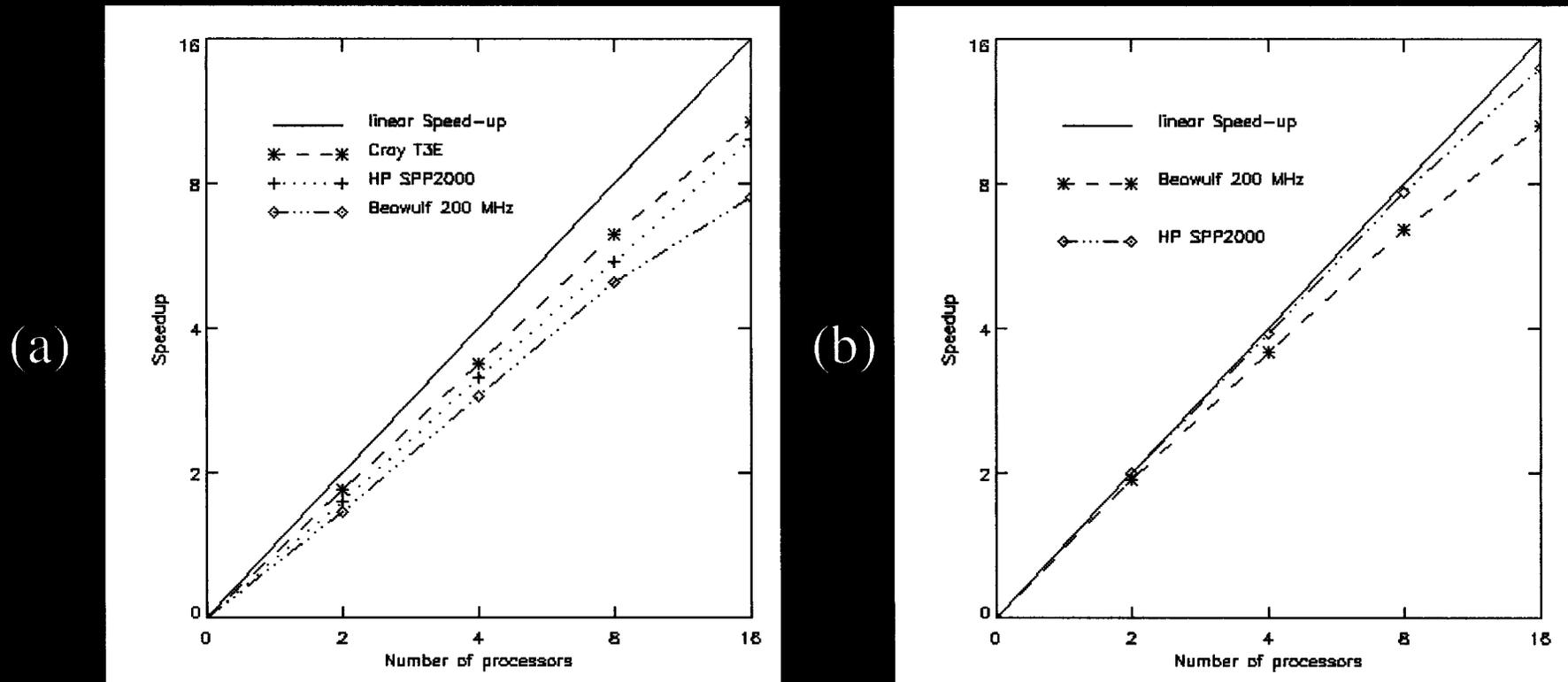
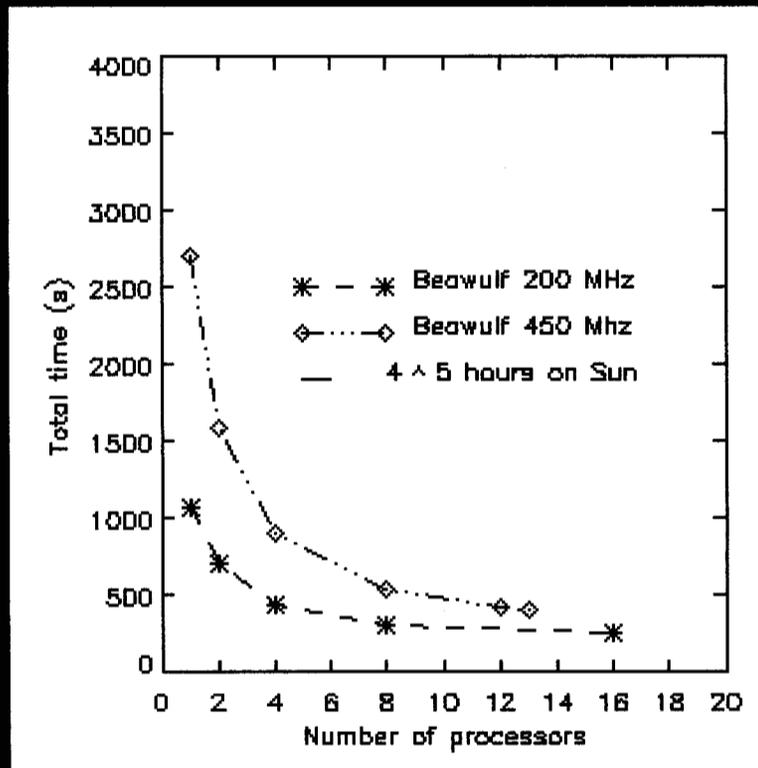# Performance Results-Speedup

Fig 2. Speedup of parallel MODTRN (a) and the parallel Nonlinear Least Squares Fitting code (b) parallel systems

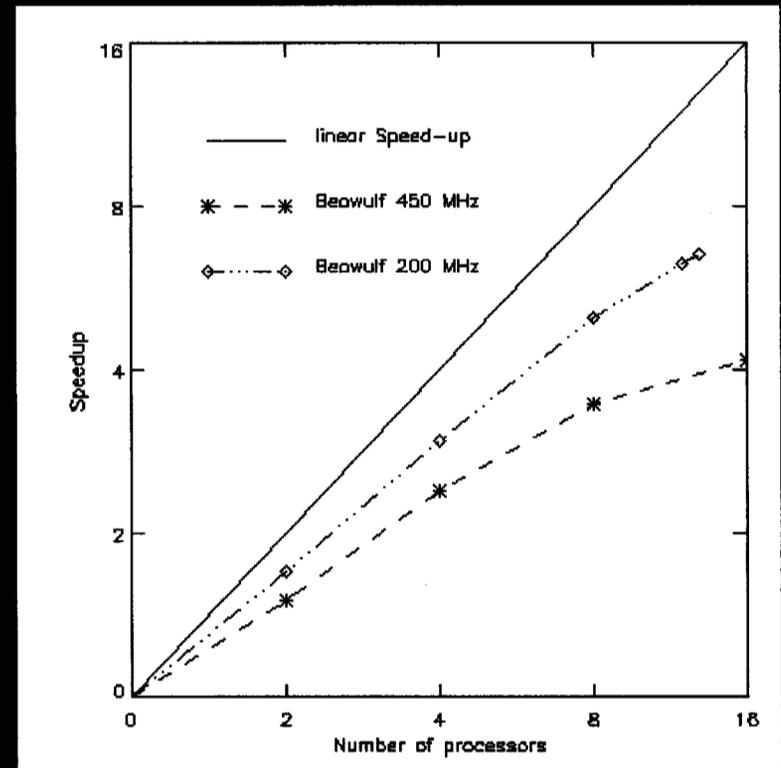# The AVIRIS Software Package on PC Clusters

(a)

(b)

Fig 3. Real time comparison for the AVIRIS software (a) and speed-up of the package on two Beowulf systems (200 MHz and 450 MHz).

Conclusions

• The parallel software is portable to various computing systems.

• The entire package works well on different parallel systems, such as the Beowulf clusters and the Cray T3x.

• The parallel version gives excellent speed-up.

• The Beowulf systems give the best performance among several parallel systems.

• The parallel MODTRAN can be to be integrated to other projects.

• The parallel AVIRIS software is ready for various applications.

Useful Links

Information about the parallel MODTRAN:

   http://www-hpc.jpl.nasa.gov/RIB/repositories/jpl-hpclib/catalog/

Information about the parallel AVIRIS package:

   contact Robert Green for details.

Information about Beowulf PC clusters:

   contact Ping Wang for details.