

## SOFTC: A Software Correlator for VLBI

NASA's Jet Propulsion Laboratory, Pasadena, California

SOFTC is an advanced software implementation of a signal correlator for very-long-baseline interferometry (VLBI) for measuring positions of natural celestial objects and distant spacecraft. Because of increases in processing speeds of general-purpose computers, software VLBI correlators have become viable alternatives to hardware ones. The input to SOFTC consists of digitized samples of raw VLBI-antenna received-signal voltages. Optionally, SOFTC also tracks calibration tones superimposed on the received signals.

The outputs of SOFTC are (1) phases and amplitudes as functions of time and frequency for cross-correlated received signals and (2) phases and amplitudes as functions of time, station, and tone number for the calibration tones. SOFTC was created to be as accurate as possible, capable of processing essentially any VLBI data, pass strong debugging tests, have a simple user interface, and have no platform dependencies. SOFTC is written modularly in the C programming language. The great advantage of implementing a correlator in

software, in contradistinction to hardware, is that it becomes relatively easy and much less expensive and time-consuming to adapt, modify, improve, and update the correlator.

*This program was written by Stephen Lowe of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

*This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-41072.*

## Progress in Computational Simulation of Earthquakes

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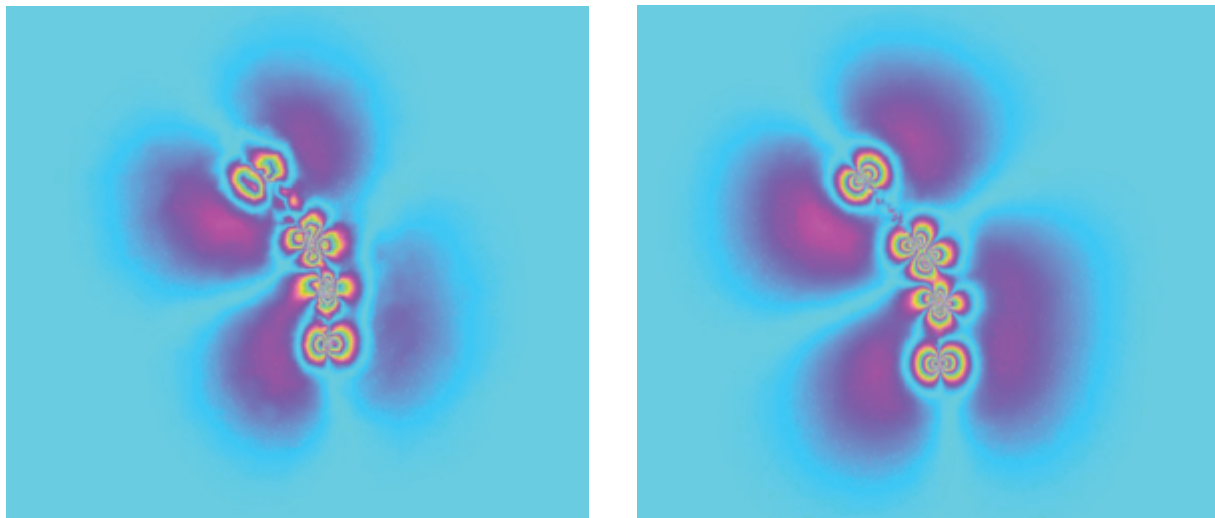
GeoFEST(P) is a computer program written for use in the QuakeSim project, which is devoted to development and improvement of means of computational simulation of earthquakes. GeoFEST(P) models interacting earthquake fault systems from the fault-nucleation to the tectonic scale. The development of GeoFEST(P) has involved coupling of two programs: GeoFEST and the Pyramid Adaptive Mesh Refinement Library. GeoFEST is a message-passing-interface-parallel code that utilizes a finite-element technique to simulate evolution of stress, fault slip, and plastic/elastic defor-

mation in realistic materials like those of faulted regions of the crust of the Earth. The products of such simulations are synthetic observable time-dependent surface deformations on time scales from days to decades. Pyramid Adaptive Mesh Refinement Library is a software library that facilitates the generation of computational meshes for solving physical problems. In an application of GeoFEST(P), a computational grid can be dynamically adapted as stress grows on a fault. Simulations on workstations using a few tens of thousands of stress and displacement finite elements can now be expanded to

multiple millions of elements with greater than 98-percent scaled efficiency on over many hundreds of parallel processors (see figure).

*This work was done by Andrea Donnellan, Jay Parker, Gregory Lyzenga, Michele Judd, P. Peggy Li, Charles Norton, Edwin Tisdale, and Robert Granat of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

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**Models of Landers, CA, Earthquake Deformation** are shown at two resolutions. These images show the accuracy improvement going from 82,000 finite elements on four processors (left) to 1.4 million finite elements on 64 processors (right).