CHAIWOOT BOONYASIRIWAT
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CURRICULUM VITAE

RESEARCH INTERESTS:

Scientific computing and visualization, signal and image processing, forward modeling and inversion problems, and computer graphics.

EDUCATION:

Ph.D. Computing, Scientific Computing Track
2005-present University of Utah, Salt Lake City, UT, USA
- Advisor: Prof. Sikorski, School of Computing, University of Utah
- Co-advisor: Prof. Schuster, Department of Geology and Geophysics, University of Utah

M.S. Computational Engineering and Science
2002-2004 University of Utah, Salt Lake City, UT, USA
- Thesis: "FORTRAN 77 Implementation of the circumscribed ellipsoid algorithm for computing fixed points"
- Advisor: Prof. Sikorski, School of Computing, University of Utah

B.S. Physics
1998-2001 Mahidol University, Bangkok, Thailand
- Senior Research Projects: "An algorithm for generating an adaptive grid for solving 1-D Maxwell's equations" and "Calculating the sensitivity matrix using reciprocity"
- Advisor: Asst. Prof. Weerachai Siripunvaraporn, Department of Physics, Mahidol University

RESEARCH EXPERIENCE:

Interferometric Tomograms of the Saudi CDP Field Data
2005-present University of Utah, Salt Lake City, UT, USA
Goals
- To determine the horizontal velocity distribution between two layers of the Saudi CDP field data.

Results
- The velocity distributions with varied shot-geophones intervals are consistent.
- The velocity distributions are computed in relative sense because the depths of the reflectors and the thickness between the reflectors are unknown.

Estimation of Friendswood's Weathering Zone Velocity Distribution of Fermat's Interferometry Principle

2005-present University of Utah, Salt Lake City, UT, USA

Goals

- To determine the horizontal velocity distribution of the weathering zones of the Friendswood VSP field data.
- To test the effectiveness of the Fermat's interferometric principle.

Results

- Fermat's interferometric principle is very fast and simple to implement.
- Horizontal velocity distributions of two weathering zones have been estimated. The results are consistent with the previous result using wave-equation tomography (WET).

FORTRAN 77 Implementation of the Circumscribed Ellipsoid Algorithm for Computing Fixed Points

2003-2004 University of Utah, Salt Lake City, UT, USA

Goals

- To implement a stable and efficient FORTRAN 77 implementation of the circubscribed ellipsoid algorithm for computing fixed points by employing a rank-one modification of sysmetric eigenproblem algorithm.
- To compare the efficiency between the circumscribed ellipsoid and simple iteration algorithms by comparing speedup and the number of function evaluations.

Results

- The circumscribed ellipsoid algorithm has been improved and implemented in FORTRAN 77.
- When the contracting factors of testing functions approach 1.0, speedup and the number of function evaluations of the circumscribed ellipsoid algorithm are improved dramatically over those of the simple iteration algorithm.

Morphological Segmentation and Statistical Analysis of the Trench Wall Stratigraphy: Mapleton Mega-Trench, Utah

2003-present University of Utah, Salt Lake City, UT, USA

Goals

- To develop algorithms for rock segmentation of the Mapleton mega-trench images.
- To differentiate colluvial wedges, debris flow deposits and channel deposits using statistical properties of segmented rocks, e.g., orientation, area, eccentricity.

Results

- The succesful rock segmentation algorithm comprises of a series of fundamental algorithms, i.e., histogram normalization, thresholding, edge detection, edge linking, watershed transform, opening, and dilation.
- Channel deposits can be statistically differentiated from colluvial wedge and debris flow deposits, while colluvial wedge and debris flow deposits can be statistically differentiated only in rock orientation.

Regularized Deconvolution

Fall 2003 University of Utah, Salt Lake City, UT, USA

Goals

- To develop a more efficient deconvolution algorithm than the Wiener deconvolution filter.

Results

- A more effiecient deconvolution algorithm is obtained when using the deconvolution result of the regularized least-square method which is improved by using a median filter as *a priori*

model. Image improvement metrices used in this project are signal-to-noise ratio (SNR) and improved-signal-to-noise ratio (ISNR).

Detection of Defects in Potato Tissues
Spring 2003 University of Utah, Salt Lake City, UT, USA
Goals
- To model the dynamics of photon transport through potato tissues using stochastic and diffusion approximation approaches.
- To solve for the solutions of the models: using Monte Carlo method for the stochastic model and convolution method for the diffusion apprcximation model.

Results
- The Monte Carlo method is implemented in MATLAB, serial and parallel C programming. For the parallel implementation, we used Message-Passing Interface (MPI).
- The Monte Carlo method is very powerful and gives the predictions that satisfy the actual data.

Calculating the Sensitivity Matrix using Reciprocity Theorem
2002 Mahidol University, Bangkok, Thailand
Goals
- To solve the 2-D Maxwell's equation using finite difference method.
- To calculate the sensitivity matrix using direct method and reciprocity theorem.
- To study the characteristic of the sensitivity matrix.

Results
- Calculating the sensitivity matrix using reciprocity theorem is much more efficient.
- Characteristics of the sensitivity matrix depend on discretization, wave period, model, etc.

An algorithm for generating an adaptive grid for solving 1-D Maxwell's equations
2002 Mahidol University, Bangkok, Thailand
Goals
- To develop an algorithm for generating an effective grid for solving the Maxwell's equations using finite difference and finite element methods.

Results
- Efficient grid discretization depends strongly on the characteristic of fields.

1-D Electromagnetic Modeling using Finite Difference and Finite Element Methods
2001 Mahidol University, Bangkok, Thailand
Goals
- To solve the 1-D Maxwell's equation using analytical, finite difference, and finite element methods.
- To develop algorithms to do 1-D magnetotelluric forward modeling.
- To study the effect of grid discretization on the accuracy of numerical solutions.
- To compare the efficiency of finite difference and finite element algorithms.

Results
- Programs for analytically and numerically solving the Maxwell's equations are developed.
- Efficient grid discretization should be refined in the area of rapidly changing fields, and should be uniform in the area of considerably slow changing fields.
- Efficiency of finite difference and finite element algorithms depend on the characteristic of fields and electrical resistivity model used. Thus, they can not be directly compared together.

Simulation of Projectile Motion
1997 Samsenwittayalai School, Bangkok, Thailand
Goals
- To numerically simulate the projectile motion with air resistance.
- To determine the function of round-off error of numerical solutions in term of discrete version of physical quantities when using Euler method and 4^{th}-order Runge-Kutta method.
- To compare the computational time used between C and JAVA program.

Results
- JAVA Simulation program can run properly on web browsers.
- The error functions can be determined only in the case of 1^{st}-order air resistance force.
- C program uses significantly less computational time than JAVA program.

WORK EXPERIENCE:

Summer Internship
Summer 2005 INCO, St. John's, Newfoundland, Canada
- Developed traveltime tomography software with Borland C++ Builder.

Research Assistant
2005-present University of Utah, Salt Lake City, UT, USA
- Research in the field of seismic interferometry, tomography, and migration.

Research Assistant
2003-2004 University of Utah, Salt Lake City, UT, USA
- Head of the Visualization Department of the Computational Science & Engineering Online (CSEO).
- Developed web-based tools called *QChemViz* and *BioViz* for viewing chemical molecules and biological macromolecules using Java3D, respectively.

Graduate Assistant
2002-2003 University of Utah, Salt Lake City, UT, USA
- Java programmer and web designer of the Computational Science & Engineering Online (CSEO).
- Developed a web-based tool for building 2D and 3D molecules using Java and interfacing with *Gaussian*.

Web Master
2003-present University of Utah, Salt Lake City, UT, USA
- Web master of Thai Student Association at the University of Utah (TSAUU).

Spring 2003 University of Utah, Salt Lake City, UT, USA
- Web master of The International Working Group on Gender, Macroeconomics and International Economics (GEM-IWG).

PRESENTATION AT CONFERENCES:

1. C. Boonyasiriwat, "One-dimensional Electromagnetic Modeling using Finite Difference and Finite Element Methods: The Magnetotelluric Method", London International Youth Science Forum (LIYSF), London, 2002.
2. C. Boonyasiriwat, "The Projectile Motion CAI using JAVA", 49th INTEL International Science and Engineering Fair (ISEF), Forth Worth, TX, USA, 1998.

PUBLICATIONS:

1. C. Boonyasiriwat, "Estimation of Friendswood's Weathering Zone Velocity Distribution using Fermat's Interferometric Principle", UTAM 2004 Annual Report, 167-174.
2. J. B. Willis, C. Boonyasiriwat, and G. T. Schuster, "Digital Log of the Mapleton, Utah Mega-trench: Optical Analysis of a Trench Wall Using Morphological Image Processing Operations", Geoscience in a Changing World, 2004 Annual Meeting & Exposition, November 7-10, Colorado Convention Center, Denver, 2004.
3. T. N. Truong, T. Cook, M. Nayak, C. Boonyasiriwat, L. T. Tran, and S. Zhang, "Computational Science and Engineering On-line: an integrated web-based environment for multi-scale modelling of complex reaction systems," Molecular Physics, 102, 4, 353-360, 2004.
4. C. Boonyasiriwat, J. B. Willis, and G. T. Schuster, "Martian and Terrestial Optical Stratigraphy by Morphological Processing", UTAM 2003 Annual Report.
5. C. Boonyasiriwat and W. Siripunvaraporn, "Calculating the Magnetotelluric Sensitivity Matrix using Reciprocity," The 6th Annual National Symposium on Computational Science and Engineering, April3-5, 2002.
6. C. Boonyasiriwat and W. Siripunvaraporn, "Algorithm for generating an adaptive grid for solving one-dimensional Maxwell's equations," 27th Congress on Science and Technology of Thailand, 17-08P-01, p. 366, 2001.
7. C. Boonyasiriwat and K. Jaroensutasinee, "Simulation of wave motion by JAVA," 25th Congress on Science and Technology of Thailand, G-01, p. 1198-1199, 1999.

SELECTED SOFTWARES:

Seismic Panel

2005 Developed under Summer Internship with INCO

- Seismic Panel provides interactive tools for designing arbitrary velocity models.
- Forward modeling can be done by using straight- and curved ray tracing, and finite difference solution of eikonal equation.
- Traveltime inversion can be done by least-squared, ART, steepest descend methods.

BioViewer

2003 Developed under the CSEO project

- A biological macromolecule visualization tool developed by using JOGL API.
- BioViz allows viewing Protein Data Bank (PDB) files in various visualization models.

QChemViz

2003 Developed under the CSEO project

- A chemical molecule visualization tool developed by using JOGL API.

- QChemViz allows viewing XYZ, COM, and PDB input files in three-dimensional view.
- QChemViz can visualize electric density or molecular orbital data as isosurfaces.

MolBuilder

2002 Developed under the CSEO project

- A molecule builder tool developed by using Java.
- MolBuild allows building molecular species from atoms, fragments, and Simplified Molecular Input Line Entry System (SMILES) notations.
- Molecules can be visualized in three-dimensional view.

Integrated Scientific Simulation

2001 Supported by NECTEC, Thailand

- A simulation tool developed by using Microsoft Visual C++.
- This program can simulate two-dimensional wave phenomena, one-dimensional heat conduction, forced harmonic motion of a pendulum, and two-dimensional electrostatics.

Simulation of Electromagnetic Wave from Antennas

2000 Supported by NECTEC, Thailand

- A computer-aided-instruction (CAI) program developed by using Java to visualize electromagnetic wave produced by electric dipole.

TECHNICAL SKILLS:

- Operating systems: MS-DOS, Windows 3.1/95/98/2000/XP, UNIX, LINUX
- Programming languages: C/C++, JAVA, FORTRAN 77, PHP, TCL/TK, VTK
- Mathematical packages: MATLAB, MATHEMATICA, MAPLE
- Scientific computing libraries: MPI, LAPACK
- Work processing packages: MS-Word, LaTeX
- Software development packages: Borland JBuilder, CVS, Microsoft Developer Studio
- Graphics packages: Adobe Photoshop, Adobe Illustrator, GIMP, XFIG
- Graphics libraries/APIs: Java3D, OpenGL, Java Bindings to OpenGL (JOGL)
- Seismic software/packages: Vista, GeoGraphix, Seismic Unix (SU), DSISoft, CREWES

AWARDS AND HONORS:

- Scholarship from the Development and Promotion of Science and Technology Talents Project (DPST) (1995-present)
- Outstanding Physics Student with the Highest GPA Award from Professor Taeb Nilanithi Foundation, Thailand (2002)
- Outstanding Science Student from the Mahidol University, Thailand (2002)
- Research grant from the Junior Science Talent Project (JSTP) (2001)
- Software development grants from the National Electronic and Computer Technology Center (NECTEC) (1997-2001)
- Outstanding Physics Student with the Highest GPA Award from Faculty of Science, Mahidol University, Thailand (2001)
- Second prize for education program in NECTEC Small Software Competition (1998)
- First prize for internet program in NECTEC Small Software Competition (1997)