Technical Program for the First International Workshop on Rotational Seismology and Engineering Applications

General Session: **Tuesday Morning**, 18 September 2007 (Open to ***Everyone***, in the Conference Room A, Building 3, USGS Menlo Park) *Maria Todorovska (USC) and Mehmet Çelebi (USGS), Chairs* [Speakers are underlined]

9:00 – 9:10 Welcome (R.D. Catchings, Chief Scientist, Earthquake Hazards Team, USGS)

9:10 – 9:35 An Introduction to the Workshop on Rotational Seismology and Engineering Applications (W.H.K. Lee, M. Çelebi, and M.I. Todorovska)

9:35 – 10:00 Observations of Rotational Ground Motions from Local Earthquakes in Taiwan (W.H.K. Lee, B.S. Huang, C.C. Liu, T.L. Teng, and C.F. Wu)

10:00 – 10:20 Break

10:20 – 11:10 Rotations in Structural Response (M.D. Trifunac)

11:10 – 12:00 Observations of Rotational Ground Motions using Ring Laser Gyros (H. Igel, A. Cochard, A. Flaws, W. Suryanto, B. Schuberth, U. Schreiber, D.N. Pham, and A. Velikoseltsev)

12:00 – 13:30 Lunch at the Vallombrosa Center

Oral Session: **Tuesday Afternoon**, 18 September, 2007 (by Invitation only, in the Library of the Vallombrosa Center) *Heiner Igel (U. Munich), Chair*

13:30 – 13:50 The Single-Couple Component of the Far-Field Radiation from Dynamical Fractures (L. Knopoff and Y.T. Chen)

13:50 – 14:10 Fundamental Deformations in Asymmetric Continua: Motions and Fracturing (R. Teisseyre and M. Gorski)

14:10 – 14:30 Sagnac Interferometry for the Determination of Rotations in Seismology (K.U. Schreiber, J.-P. Wells, A. Carr, H. Igel, S. Voigt, and A. Velikoseltsev)

14:30 – 14:50 Integrating GPS with Rotational and Inertial Sensors (K. Hudnut and A. Borsa)

14:50 – 15:10 Rotational Measurements in Structures – Why and How? - Engineers' Perspective and Experience (M. Celebi, E. Kalkan and S. Pezeshk)

15:10 – 15:30 Instrument Correction for 6DOF Seismic Sensors (M.I. Todorovska and M.D. Trifunac)

15:30 – 18:00 Reception at the Vallombrosa Mansion and Poster Previews (by Invitation only)

Poster Session: **Wednesday Morning**, 19 September, 2007 (by Invitation only at the East Parlor and Stage Room, Vallombrosa Mansion) *John Evans (USGS), Chair*

9:00 – 12:00 Author should be at his/her poster for at least two half-hour periods. Please post those times on the poster panel.

Boroschek, R.: Engineering Implications of Rotational Sensitivity of Translational Accelerometers

Cadena-Isaza, A., F.J. Sánchez-Sesma, L. Godinho and P.A. Mendes: Rotational Ground Motion at Topographical Features for Incident Elastic Waves Using Boundary Integral Formulations

Castellani, Alberto and Marco Stupazzini: Response spectrum of rotation: elaboration of cross power spectra got from closely spaced instruments.

DeSalvo, Riccardo (for the SAS team): The SAS Primary Seismic Attenuation System for Advanced LIGO

Dunn, R.W.: A Ground Motion Sensing Triangular Laser 51-m in Perimeter

Evans, John R., Ramanath Cowsik, Charles R. Hutt, C.-C. Liu, Robert Nigbor, Ulrich Schreiber, Frank Vernon, and Erhard Wielandt: Development of Methods for Testing Rotational Sensors

Ghayamghamian, M. Reza, and G.R. Nouri: An Estimation of Torsional Motion Using Dense Array Data and Its Effect on the Structural Response

Gicev, V., and M.D. Trifunac: Rotations in a Seven-Story Building Caused by Nonlinear Waves During Earthquake Excitation

Górski, Marek, and Krzysztof P. Teisseyre: Rotation Measurements in Seismological Observatories: Ojcow (Poland), Ksiaz (Poland), L'Aquila (Italy) and on Pasterze Glacier (Austria)

Graizer, Vladimir: Rotational Effects in Seismology and Engineering

Hautmann, Jan, Robert Barsch, Joachim Wassermann, Heiner Igel, Susanne Lehndorfer, Alex Velikoseltsev, Ulrich Schreiber: Rotation Data from RingLaser Gyroscopes: Online Visualisation and Processing

Jeremic, Boris: Computational Tools for Seismic Nonlinear Wave Propagation, Including Surface (Rotational) Effects and Soil-Structure Interaction.

Kalkan, Erol: Rotational Components and Their Impacts on Structural Systems

Kozak, Jan T.: Earthquake Rotational Effects – Historical Examples

Lehndorfer, S., J. Hautmann, W. Suryanto, D.N. Pham, A. Cochard, J. Wassermann, H. Igel, and U. Schreiber: New Zealand Ring Lasers: Rotational Motions Around Horizontal Axes

Lee, V.W.: Rotational Components of Elastic Waves on the Half-Space Surfaces.

Liu, C.C., B.S. Hunag, W.H.K. Lee, and T.L. Teng: Measuring Rotational Motions from Local Earthquakes at the HGSD Station in Taiwan

Majewski, Eugeniusz: Rotational Seismic Waves and Solitons

Musson, R.M.W., and S.L. Sargeant: Rotational Earthquake Motions Observed in the UK

Nigbor, R.L., Evans, J.R., and Hutt, C.R.: Laboratory and Field Testing of Commercial Rotational Seismometers

Pham, N.D., H. Igel, A. Cochard, U. Schreiber, A. Velikoseltsev, M. Käser, J. de la Puente, and F. Gallovic: Rotational Signals in the *P* Coda

Pillet, Robert, Jean Virieux, and Yves Guglielmi: Evidence of the Torsion Motion (Rotation Around the Vertical Axis) on Seismic Recordings

Shamsabadi, Anoosh, and Liping Yan: Rotational Response of Skewed Bridges Subjected to Near-Field Ground Motions

Spudich, Paul, and Jon B. Fletcher: Observation and Prediction of Dynamic Ground Strains, Tilts and Torsions Caused by the M6.0 2004 Parkfield, California, Earthquake and Aftershocks, Derived from UPSAR Array Observations

Takamori, Akiteru, Akito Araya, and Yuji Otake: A Rotational Seismometer Utilizing the Pinning Effect of a Superconductor

Takeo, Minoru: Rotational Motions Observed During an Earthquake Swarm in April, 1998, at Offshore Ito, Japan

Teisseyre, Roman: Physics of Rotation Motions: Spin and Twist

Wassermann, J., S. Lehndorfer, and J. Hautmann: Global Observation of Rotation Ground Motions: Towards a Unified Data Portal and "Real-Time" Analysis

Wells, Ray E. and Robert McCaffrey: Rotation of Crustal Blocks in the Western U.S.

Zembaty, Zbigniew: Stochastic Approach in the Analysis of Rocking Ground Motion

Group and General Discussions on Key Issues and Future Research Plans in Rotational Seismology and Engineering: **Wednesday Afternoon**, 19 September, 2007 (by Invitation only, in the Library of the Vallombrosa Center) *Willie Lee (USGS) and Maria Todorovska (USC), Chairs*

13:00 – 13:10 Assignment of 5 Locations for Individual Group Discussions

13:10 – 15:10 Participants may join any one of the following groups for discussions on key issues and plans for future research:

(1) Theoretical Studies of Rotational Motions (*L. Knopoff*, Group Leader)
(2) Measuring Far-Field Rotational Motions (*H. Igel*, Group Leader)
(3) Measuring Near-Field Rotational Motions (*T.L. Teng*, Group Leader)
(4) Engineering Applications of Rotational Motions (*M. Trifunac*, Group Leader)
(5) Design and Testing Rotational Sensors (*J. Evans*, Group Leader)

15:10 – 15:30 Break

15:30 – 17:00 Group Leader Summaries, and General Discussion

17:00 – Workshop adjourns

Post-Workshop Special Session with LIGO Physicists: **Thursday Morning, 20 September, 2007** (by Invitation only, in Conference Room C, Building 3, USGS Menlo Park) *Willie Lee (USGS), Chair*

"The Laser Interferometer Gravitational-wave Observatory (LIGO) is an ambitious project to measure gravitational waves from astrophysical sources and use these measurements to open a new observational window on the universe." LIGO physicists are pushing the limits of technology in trying to measure a predicted motion of less that 10 picometers rms between 1 and 100 Hz. We are fortunate to have *Riccardo DeSalvo* and *Brian Lantz* to share their experience with us in a small group meeting.

9:00 – 9:05 Welcome (*Willie Lee*, USGS)

9:05 – 9:35 An Introduction to Einstein's Gravitational Waves (*B. Lantz*, Stanford)

9:35 – 10:15 Seismic Isolation System for the Advanced LIGO Project (*B. Lantz*, Stanford)

10:15 – 10:30 Break

10:30 – 11:10 Review of accelerometer developments and possible use of the control signals of Gravitational Wave Intefrerometer seismic isolators to extract signals of geophysical interest. (R. DeSalvo, Caltech)

11:10 – 12:00 Discussions

12:00 – 13:00 Lunch

13:00 Session adjourns, but additional discussions may continue.