

Symposium on Mechanics in Geophysical and Materials Sciences  
**In Honor of Professor James R. Rice**



January 20-22, 2011

California Institute of Technology, Pasadena, California 91125

## Program

**Thursday, January 20, 2011**

- 7:30-8:30      *Breakfast and Registration, Beckman Mall*
- Session I**      **Chairs: Nadia Lapusta and G. Ravichandran**
- 8:30-9:00      **Welcome remarks:**  
**Jean-Lou Chameau** (Caltech President)  
**Ares Rosakis** (Chair, Division of Engineering and Applied Science, Caltech)  
**Michael Gurnis** (Director, Seismological Laboratory, Caltech)
- 9:00-9:30      **John Hutchinson**, Harvard University  
*Energy states and wrinkle patterns of buckled films on compliant substrates*
- 9:30-10:00      **Victor Tsai**, U.S. Geological Survey  
*A model for turbulent hydraulic fracture and applications to crack propagation at glacier beds*
- 10:00-10:30      *Break, Beckman Mall*
- Session II**      **Chairs: Jean-Paul Ampuero and Ralph J. Archuleta**
- 10:30-11:00      **Paul Segall**, Stanford University  
*Slow slip and dynamic rupture in subduction zones with application to Cascadia*
- 11:00-11:30      **Yajing Liu**, Woods Hole Oceanographic Institute  
*Frictional behavior of oceanic transform faults and influence on earthquake characteristics*
- 11:30-12:00      **Eric M. Dunham**, Stanford University  
*Flow of compressible fluids through cracks in elastic bodies and excitation of volcanic tremor*
- 12:00-1:30      *Lunch, Beckman Mall*

**Session III****Chairs: Peter M. Anderson and Thomas H. Jordan**

- 1:30-2:00      **Alan Needleman**, University of North Texas  
*Prediction of ductile fracture surface roughness*
- 2:00-2:30      **Huajian Gao**, Brown University  
*Atomistic simulations and modeling of plastic deformation mechanisms in hierarchical nanotwinned metals*
- 2:30-3:00      **Nora DeDontney**, Harvard University  
*Numerical modeling of fault branch activation in subduction zones and strike-slip settings*
- 3:00-3:30      **Ares Rosakis**, California Institute of Technology  
*Identifying the unique ground motion signatures of super-shear vs. sub-Rayleigh earthquakes: Theory, experiments and seismic risk*
- 3:30-4:00      *Break, Beckman Mall*

**Session IV****Chair: Hiroyuki Noda**

- 4:00-5:00      *Poster Session, Beckman Mall*
- 5:00-6:00      *Poster Session/Lab Tours, Beckman Mall*

**6:00*****Reception, Athenaeum*****Friday, January 21, 2011**

- 7:30-8:30      *Breakfast, Beckman Mall*

**Session V****Chairs: Kaushik Bhattacharya and Yuri Fialko**

- 8:30-9:00      **John Willis**, University of Cambridge  
*Wave-modulated orbits in rate-and-state friction*
- 9:00-9:30      **Terry Tullis**, Brown University  
*Frictional ageing due to adhesion changes at the nanoscale, relevant to the origin of the evolution effect in rate and state friction*
- 9:30-10:00      **Nadia Lapusta**, California Institute of Technology  
*Reproducing source characteristics of the 1999 Chi-Chi earthquake in a model with laboratory-based fault properties*
- 10:00-10:30      *Break, Beckman Mall*

<b>Session VI</b>	<b>Chairs: Ronaldo I. Borja and Jean Sulem</b>
10:30-11:00	<b>Zdeněk Bažant</b> , Northwestern University <i>Probabilistic theory of static and cyclic fatigue lifetime of quasibrittle and brittle structures based on nano-mechanics</i>
11:00-11:30	<b>Mark Kachanov</b> , Tufts University <i>On the effective properties of heterogeneous materials and cross-property connections</i>
11:30-12:00	<b>José Andrade</b> , California Institute of Technology <i>Multiscale modeling and characterization of granular matter: From grain scale kinematics to continuum mechanics</i>
12:00-12:15	<b>Symposium group photo</b> , Steps of Beckman Auditorium
12:15-1:30	<i>Lunch, Beckman Mall</i>
<b>Session VII</b>	<b>Chairs: Greg Beroza and Jay Fineberg</b>
1:30-2:00	<b>Toshihiko Shimamoto</b> , Institute of Geology <i>Subduction-zone seismicity and emerging new problems in fault mechanics</i>
2:00-2:30	<b>Miaki Ishii</b> , Harvard University <i>Rupture characteristics of large intermediate-depth earthquakes and their generation mechanism</i>
<b>Session VIII</b>	<b>Chair: Bill Ellsworth</b>
2:30-3:30	<b>Mechanics in Geophysical Sciences: Discussion of future directions</b> <b>Panelists:</b> <b>Jean-Philippe Avouac</b> , California Institute of Technology <b>James Dieterich</b> , University of California, Riverside <b>Yves Guéguen</b> , École Normale Supérieure
3:30-4:00	<i>Break, Beckman Mall</i>
<b>Session IX</b>	<b>Chair: Robert Viesca</b>
4:00-5:00	<b>Poster Session</b> , Beckman Mall
5:00-6:00	<b>Poster Session/Lab Tours</b> , Beckman Mall
<b>6:00</b>	<b>Banquet, Athenaeum</b>

## Saturday, January 22, 2011

- 7:30-8:30 *Breakfast, Beckman Mall*
- Session X**      **Chairs: Katia Bertoldi and Michael Gurnis**
- 8:30-9:00      **Ben Freund**, University of Illinois at Urbana-Champaign  
*Dependence of the rate of diffusive escape from an energy well on the dimensionality of the well*
- 9:00-9:30      **Zhigang Suo**, Harvard University  
*Poroelasticity of gels – when mechanics meets chemistry*
- 9:30-10:00      **Robert M. McMeeking**, University of California, Santa Barbara  
Models for lithium-ion battery performance and damage
- 10:00-10:30      *Break, Beckman Mall*
- Session XI**      **Chair: Michael Ortiz**
- 10:30-11:30      **Mechanics of Materials: Discussion of future directions**  
**Panelists:**  
**Yonggang Huang**, Northwestern University  
**Kyung-Suk Kim**, Brown University  
**David Parks**, Massachusetts Institute of Technology
- 11:30-1:00      *Lunch, Beckman Mall*
- Session XII**      **Chair: Harsha S. Bhat**
- 1:00-2:30      *Poster Session, Beckman Mall*
- Closing Session**      **Chair: Ares Rosakis**
- 2:30-3:30      **Closing Lecture, James R. Rice**, Harvard University
- 3:30-4:00      **Farewell**

## Poster Presentations

<i>Slab stress and strain rate as constraints on global mantle flow</i>	<b>P1</b>
<b>Laura Alisic<sup>1</sup>, Michael Gurnis<sup>1</sup>, Georg Stadler<sup>2</sup>, Carsten Burstedde<sup>2</sup>, Lucas Wilcox<sup>2,3</sup>, and Omar Ghattas<sup>2</sup></b> , <sup>1</sup> California Institute of Technology, <sup>2</sup> University of Texas at Austin, <sup>3</sup> HyPerComp	
<i>Relations between slow slip and tremor in models of fault asperity interactions mediated by transient creep</i>	<b>P2</b>
<b>Jean-Paul Ampuero</b> , California Institute of Technology	
<i>A rate-dependent plasticity model for dilative granular media</i>	<b>P3</b>
<b>José E. Andrade, Phong B.H. Le, Quisi Chen, Carlos F. Avila</b> , California Institute of Technology	
<i>Inferring fault friction laws from geodetic observations of co- post- and interseismic deformation</i>	<b>P4</b>
<b>Jean-Philippe Avouac<sup>1</sup>, Hugo Perfettini<sup>2</sup>, Andrew Kosistsky<sup>1</sup>, Sylvain Barbot<sup>1</sup>, and Shu-Hao Chang<sup>1</sup></b> , <sup>1</sup> California Institute of Technology, <sup>2</sup> Institut de Recherche pour le Développement	
<i>Seismic streaks and holes: geometric control of the Parkfield Mw6.0 earthquakes</i>	<b>P5</b>
<b>Sylvain Barbot, Nadia Lapusta, and Jean-Philippe Avouac</b> , California Institute of Technology	
<i>The dynamics of the onset of frictional slip</i>	<b>P6</b>
<b>Oded Ben-David, Gil Cohen, and Jay Fineberg</b> , Hebrew University of Jerusalem	
<i>Slip-stick: the evolution of frictional strength</i>	<b>P7</b>
<b>Oded Ben-David<sup>1</sup>, Shmuel M. Rubinstein<sup>2</sup>, and Jay Fineberg<sup>1</sup></b> <sup>1</sup> Hebrew University of Jerusalem, <sup>2</sup> Harvard University	
<i>An experimental and theoretical study of asymmetric earthquake rupture propagation caused by off-fault fracture damage</i>	<b>P8</b>
<b>Harsha S. Bhat<sup>1,2</sup>, Ares J. Rosakis<sup>2</sup>, and Charles G. Sammis<sup>1</sup></b> <sup>1</sup> University of Southern California, <sup>2</sup> California Institute of Technology	
<i>Effect of dehydration reactions on the stability of creeping faults</i>	<b>P9</b>
<b>Nicolas Brantut<sup>1</sup>, Jean Sulem<sup>2</sup>, and Alexandre Schubnel<sup>1</sup></b> <sup>1</sup> Ecole Normale supérieure, <sup>2</sup> Ecole des Ponts Paris Tech	
<i>Damage and rupture dynamics at the brittle/ductile transition: the case of gypsum</i>	<b>P10</b>
<b>Nicolas Brantut, Alexandre Schubnel, and Yves Guéguen</b> , Ecole Normale Supérieure	
<i>Nematic elastomers: instabilities and relaxation</i>	<b>P11</b>
<b>Pierluigi Cesana</b> , California Institute of Technology	
<i>AES for multiscale localization modeling in granular media</i>	<b>P12</b>
<b>Qiushi Chen<sup>1</sup>, José E. Andrade<sup>1</sup>, and Esteban Samaniego<sup>2</sup></b> <sup>1</sup> California Institute of Technology, <sup>2</sup> Universidad de Cuenca	
<i>Interaction of small repeating earthquakes in a rate and state fault model</i>	<b>P13</b>
<b>Ting Chen and Nadia Lapusta</b> , California Institute of Technology	

<i>The geochemical signature of carbonate-hosted seismogenic faults</i>	<b>P14</b>
<b>N. De Paola<sup>1</sup>, G. Chiodini<sup>2</sup>, T. Hirose<sup>3</sup>, C. Cardellini<sup>4</sup>, S. Caliro<sup>2</sup>, and T. Shimamoto<sup>5</sup></b> <sup>1</sup> University of Durham, <sup>2</sup> Instituto Nazionale di Geofisica e Vulcanologia, <sup>3</sup> Japan Agency for Marine-Earth Science and Technology (JAMSTEC), <sup>4</sup> Universita' di Perugia, and <sup>5</sup> Institute of Geology, China Earthquake Administration	
<i>Formation of pulse-like ruptures on velocity-weakening interfaces and its relation to stability properties of steady-state sliding</i>	<b>P15</b>
<b>Ahmed Elbanna, Nadia Lapusta, and Thomas H. Heaton</b> , California Institute of Technology	
<i>Gutenberg-Richter breakdown and the smallest earthquakes at the San Andreas Fault Observatory at Depth</i>	<b>P16</b>
<b>William L. Ellsworth</b> , U. S. Geological Survey	
<i>Origin of strong velocity weakening in high-speed rotary shear experiments on gabbro: Partial melting of the gouge layer</i>	<b>P17</b>
<b>Yuri Fialko and Kevin Brown</b> , University of California San Diego	
<i>Experimental study of ground motion attenuation of thrust faults</i>	<b>P18</b>
<b>Vahe Gabuchian<sup>1</sup>, Ares J. Rosakis<sup>1</sup>, Nadia Lapusta<sup>1</sup>, and David D. Oglesby<sup>2</sup></b> <sup>1</sup> California Institute of Technology, <sup>2</sup> University of California	
<i>Flash heating of crustal rocks at near-seismic slip rates</i>	<b>P19</b>
<b>David L. Goldsby, and Terry E. Tullis</b> , Brown University	
<i>Shearing resistance of aluminum at high strain rates and at temperatures approaching melt</i>	<b>P20</b>
<b>Stephen E. Grunschel<sup>1</sup>, Rodney J. Clifton<sup>2</sup>, and Tong Jiao<sup>2</sup></b> <sup>1</sup> ASML, Wilton, <sup>2</sup> Brown University	
<i>The SCEC-USGS dynamic earthquake rupture code verification exercise: regular and extreme ground motion</i>	<b>P21</b>
<b>Ruth A. Harris<sup>1</sup>, Michael Barall<sup>2</sup>, Ralph Archuleta<sup>3</sup>, Brad Aagaard<sup>1</sup>, Jean-Paul Ampuero<sup>4</sup>, Joe Andrews<sup>1</sup>, Victor Cruz-Atienza<sup>5</sup>, Luis Dalguer<sup>6</sup>, Steven Day<sup>7</sup>, Benchun Duan<sup>8</sup>, Eric Dunham<sup>9</sup>, Geoff Ely<sup>10</sup>, Alice Gabriel<sup>6</sup>, Yoshihiro Kaneko<sup>11</sup>, Yuko Kase<sup>12</sup>, Nadia Lapusta<sup>4</sup>, Shuo Ma<sup>7</sup>, Hiroyuki Noda<sup>4</sup>, David Oglesby<sup>13</sup>, Kim Olsen<sup>7</sup>, Daniel Roten<sup>7</sup>, Surendra Somala<sup>4</sup>, and Seok Goo Song<sup>6</sup></b> <sup>1</sup> U.S. Geological Survey, <sup>2</sup> Invisible Software, <sup>3</sup> University of California Santa Barbara, <sup>4</sup> California Institute of Technology, <sup>5</sup> Universidad Nacional Autonoma de Mexico, <sup>6</sup> Swiss Federal Institute of Technology, <sup>7</sup> San Diego State University, <sup>8</sup> Texas A&M University, <sup>9</sup> Stanford University, <sup>10</sup> University of Southern California, <sup>11</sup> University of California San Diego, <sup>12</sup> Geological Survey of Japan, <sup>13</sup> University of California Riverside	
<i>Linking postseismic and interseismic deformation along the North Anatolian Fault Zone: The role of transient rheology and low-viscosity shear zones</i>	<b>P22</b>
<b>Elizabeth H. Hearn</b> , University of British Columbia	
<i>Size effects in the failure conditions of systems with strong velocity-weakening frictional interfaces and pulselike ruptures</i>	<b>P23</b>
<b>Thomas H. Heaton and Ahmed Elbanna</b> , California Institute of Technology	

<i>Properties of dynamic slip pulses in a 2D slab</i>	<b>P24</b>
<b>Yihe Huang<sup>1</sup>, Jean-Paul Ampuero<sup>1</sup>, and Luis A. Dalguer<sup>2</sup></b> <sup>1</sup> California Institute of Technology, <sup>2</sup> SED, ETH Zürich	
<i>BIEM simulation of non-planar earthquake rupture, and its extension to inhomogeneous medium</i>	<b>P25</b>
<b>Nobuki Kame</b> , University of Tokyo	
<i>Persistence of coseismic rupture asperities as inferred from interseismic geodetic observations from Northeastern Japan</i>	<b>P26</b>
<b>Ravi V. S. Kanda<sup>1,2</sup>, Eric A. Hetland<sup>3</sup>, and Mark Simons<sup>1</sup></b> <sup>1</sup> California Institute of Technology, <sup>2</sup> National Taiwan University, <sup>3</sup> University of Michigan	
<i>Modeling shallow slip deficit in large strike-slip earthquakes using simulations of spontaneous rupture in elasto-plastic media</i>	<b>P27</b>
<b>Yoshihiro Kaneko and Yuri Fialko</b> , University of California San Diego	
<i>Frequency dependent rupture characteristics of the 2010 Mw 8.8 Chile earthquake as imaged by back-projection</i>	<b>P28</b>
<b>Eric Kiser and Miaki Ishii</b> , Harvard University	
<i>Cohesive zone law extraction from an experimental peel test for soft adhesive materials</i>	<b>P29</b>
<b>Christopher Kovalchick, Shuman Xia, and Guruswami Ravichandran</b> California Institute of Technology	
<i>Quantized crystal plasticity in nanocrystalline metals</i>	<b>P30</b>
<b>Lin Li<sup>1</sup>, Peter M. Anderson<sup>1</sup>, Steven Van Petegem<sup>2</sup>, and Helena Van Swygenhoven<sup>2</sup></b> <sup>1</sup> Ohio State University, <sup>2</sup> Paul Scherrer Institute	
<i>Physical modeling of a slope failure during 2005 typhoon Nabi in Japan</i>	<b>P31</b>
<b>Henry Ling<sup>1</sup>, and Hoe I. Ling<sup>2</sup></b> <sup>1</sup> Academy for the Advancement of Science and Technology, <sup>2</sup> Columbia University	
<i>Micromechanics of dilatancy, critical state and shear bands in granular materials</i>	<b>P32</b>
<b>Sinisa Dj. Mesarovic<sup>1</sup>, Jagan M. Padbidri<sup>2</sup>, and Balasingam Muhunthan<sup>1</sup></b> <sup>1</sup> Washington State University, <sup>2</sup> Georgia Institute of Technology	
<i>A Bayesian approach to kinematic models of all phases of the seismic cycle</i>	<b>P33</b>
<b>Sarah Minson, Francisco Ortega, Junle Jiang, Anthony Sladen, Nina Lin, and Mark Simons</b> California Institute of Technology	
<i>Simultaneous measurement of real contact area and fault normal stiffness during frictional sliding</i>	<b>P34</b>
<b>Kohei Nagata<sup>1</sup>, Brian Kilgore<sup>2</sup>, Masao Nakatani<sup>3</sup>, and Nick Beeler<sup>4</sup></b> <sup>1</sup> JMA, <sup>2</sup> U. S. Geological Survey, <sup>3</sup> ERI	
<i>Coating delamination on cylindrical substrates</i>	<b>P35</b>
<b>Ruzica R. Nikolic<sup>1</sup> and Jelena M. Djokovic<sup>2</sup></b> <sup>1</sup> University of Kragujevac, <sup>2</sup> University of Belgrade	
<i>Definitions of average stress drops for heterogeneous slip distribution: Implications for dynamic rupture process from earthquake energetics</i>	<b>P36</b>
<b>Hiroyuki Noda, Nadia Lapusta, and Hiroo Kanamori</b> , California Institute of Technology	

<i>Earthquake dynamics and potential tsunamis in the Greater Antilles Subduction Zone</i> <b>David D. Oglesby<sup>1</sup>, Eric L. Geist<sup>2</sup>, and Uri S. ten Brink<sup>2</sup></b> <sup>1</sup> University of California, Riverside, <sup>2</sup> U. S. Geological Survey	<b>P37</b>
<i>Strain localization within a fluid-saturated fault gouge layer during seismic shear</i> <b>John D. Platt<sup>1</sup>, James R. Rice<sup>1,2</sup>, and John W. Rudnicki<sup>3</sup></b> <sup>1</sup> Harvard University, <sup>3</sup> Northwestern University	<b>P38</b>
<i>Heating, melting, weakening and strengthening in a finite shear zone during earthquake slip</i> <b>Alan Rempel</b> , University of Oregon	<b>P39</b>
<i>Shaping via active deformation of synthetic and natural elastic sheets</i> <b>Eran Sharon</b> , Hebrew University of Jerusalem	<b>P40</b>
<i>Slip on the surface and slip at depth: Insights from 3D elastodynamic earthquake models</i> <b>Bruce E. Shaw</b> , Columbia University	<b>P41</b>
<i>Mechanics of layer-by-layer coated electrospun nanofiber mats</i> <b>M. N. Silberstein, J. N. Ashcraft, D. Liu, P. T. Hammond, G. C. Rutledge, and M. C. Boyce</b> Massachusetts Institute of Technology	<b>P42</b>
<i>Wrinkles of a stiff layer on a pre-stretched soft substrate</i> <b>Jeong-Yun Sun<sup>1</sup>, Shuman Xia<sup>3</sup>, Myoung-Woon Moon<sup>2</sup>, Kyu Hwan Oh<sup>1</sup>, and Kyung-Suk Kim<sup>3</sup></b> <sup>1</sup> Seoul National University, <sup>2</sup> Korea Institute of Science and Technology, <sup>3</sup> Brown University	<b>P43</b>
<i>Exploring the role of viscoelastic ice rheology for glacial flow modeling</i> <b>Jeffrey Thompson and Mark Simons</b> , California Institute of Technology	<b>P44</b>
<i>Early results from the SCEC earthquake simulator comparison project</i> <b>Terry E. Tullis<sup>1</sup>, Michael Barall<sup>2</sup>, Keith Richards-Dinger<sup>3</sup>, Steven N. Ward<sup>4</sup>, Eric Heien<sup>5</sup>, Olaf Zielke<sup>6</sup>, Fred Pollitz<sup>7</sup>, James H. Dieterich<sup>3</sup>, John Rundle<sup>5</sup>, Burak Yikilmaz<sup>5</sup>, Donald Turcotte<sup>5</sup>, Louise Kellogg<sup>5</sup>, and Edward H. Field<sup>7</sup></b> <sup>1</sup> Brown University, <sup>2</sup> Invisible Software, <sup>3</sup> UCR, <sup>4</sup> UCSC, <sup>5</sup> UCD, <sup>6</sup> ASU, <sup>7</sup> USGS	<b>P45</b>
<i>Earthquake-induced structural failures and mechanical characteristics of relevant seismic waves</i> <b>Koji Uenishi</b> , Kobe University	<b>P46</b>
<i>Poromechanical processes below the seafloor: steady sedimentation and landslide initiation</i> <b>Robert C. Viesca and James R. Rice</b> , Harvard University	<b>P47</b>
<i>A fixed-point iteration method with quadratic convergence</i> <b>Kevin P. Walker<sup>1</sup> and Sam Sham<sup>2</sup></b> <sup>1</sup> Engineering Science Software, Inc., <sup>2</sup> Oak Ridge National Laboratory	<b>P48</b>