

## Winter/Spring 1999

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CUREe is a California nonprofit corporation dedicated to the advancement of earthquake engineering. CUREe's member institutions are:



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## THE PRESIDENT'S COLUMN

Professor Karl Romstad  
 UC Davis

Approximately ten years ago I joined the first CUREe Board of Directors as the UC Davis appointed representative and served two years. The idea of forming CUREe as a private nonprofit corporation had previously been developed by a distinguished and industrious group of California earthquake engineering faculty with a commitment to reducing the loss of human life and economic impacts caused by earthquakes through research and education. The founders believed that this could only occur if earthquake engineering research was promoted and new sources of research funds were developed, particularly for large scale research activities requiring contributions from individuals on different campuses. Each of the eight founding institutions contributed \$5,000 as seed money, and many faculty, the founding officers especially, contributed enormous numbers of volunteer hours.

For about four years in the early to mid 1990's I became deeply involved in the financial, academic and political 'challenges' of the Davis Campus and the University of California systemwide and was unable to follow developments in CUREe. I became involved with CUREe again as a member of the CUREe Committee on NSF Earthquake Research Centers chaired by Paul Jennings, which was established in response to NSF's national competition to fund one or more centers, and as an At-Large Director in 1997. I was amazed to find that in a very short period of years CUREe had grown into a well organized, financially successful corporation with an effective full-time professional staff. The basis for building this success has been the unselfish giving of time and commitment by key indi-

viduals who have been involved with CUREe throughout most of the past ten years. I will not list names since I have not been involved most of that time and would certainly miss some. Clearly the Loma Prieta and Northridge Earthquakes have created opportunities for CUREe, which CUREe members have developed into major research and educational programs, all in a very unselfish manner.

But the most important key has been continued cooperation among all the individual members and member institutions in an atmosphere of open healthy debate. I believe that many people outside of California (and perhaps some within) did not believe it would be possible for California earthquake engineering faculty to cooperate as they have in evolving the success of CUREe. This sense of cooperation was never more evident than in the work of the CUREe Committee on NSF Earthquake Research Centers as it debated to reach consensus on the selection of a Host Campus and Principal Investigator to develop the NSF Center proposal. Several distinguished CUREe universities made proposals to serve as the Host Campus for the proposal. It was a difficult decision, and UC Berkeley was selected. Immediately after the decision was made unanimous, the representatives of campuses which were not selected were contributing fully and positively toward the next goal of developing a successful proposal. It was an impressive display of statesmanship and cooperation which has marked CUREe since its inception. In my judgment, PEER Director Jack Moehle has demonstrated the same laudable qualities as he led the successful proposal development process and subsequent first-year activities of PEER.

*continued on page 5*

## New CUREe Officers Selected

At its November 6th, 1998 meeting at USC, the CUREe Board of Directors selected new officers. The new officers, shown below, replace the following outgoing officers: James Beck, President; Karl Romstad, Vice-President; James Anderson, Secretary; Chia-Ming Uang, Treasurer, and Helmut Krawinkler, Past President. CUREe would like to thank the outgoing officers; their efforts have made CUREe's progress possible.



### President

### Karl Romstad

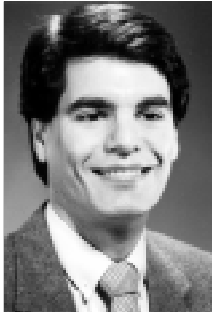
Professor Karl Romstad is currently serving as chair of the Civil Engineering Department at UC Davis and member of the PEER Board of Directors. His areas of earthquake engineering research include nonlinear dynamic analysis using reduced order models; soil-structure interaction in bridge abutment systems, soil-pile systems and reinforced earth systems; and development of damage calibrated response spectra. Professionally he has served a previous term on the CUREe Board, on the SEAOC code development subcommittee for base isolation provisions, as technical program chair at a SEAOC convention, and as chair of an ASCE subcommittee on large structural systems.



### Vice-President

### Gerard Pardoen

Gerry Pardoen is Professor of Civil & Environmental Engineering at the University of California, Irvine. He obtained his BSCE from the University of Pennsylvania and his MSCE and Ph.D. degrees in Civil Engineering from Stanford University. He primarily teaches the fundamental undergraduate CEE courses such as statics and strength of materials. At the graduate level he teaches courses in applied mechanics, finite element methods and experimental modal analysis. His research interests include analytical and experimental vibration methods, nonlinear response of shell membrane structures as well as the cyclic testing and behavior of concrete and timber structures. He is currently supervising four doctoral students, and serves as the Assistant Director for Education for the Pacific Earthquake Engineering Research Center.



### Secretary

### Gregory Fenves

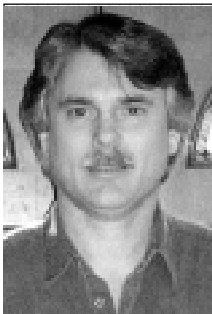
Gregory Fenves is the T.Y. and Margaret Lin Professor of Civil Engineering at UC Berkeley. He obtained a BS degree from Cornell University and a MS and Ph.D. degree from UC Berkeley. His primary research areas are in structural dynamics for earthquake engineering problems. Specific research has included response simulation of bridges, dams, and soil-structure systems. Other current research includes experimental and analytical studies of seismic isolation for bridges, and development of advanced simulation software. He teaches graduate courses in nonlinear structural analysis, structural dynamics, finite element methods, and computer-aided engineering. He is the author of over 70 technical papers, reports, and publications. He is a recipient of the NSF Presidential Young Investigator Award and three awards from the American Society of Civil Engineers. Prof. Fenves is the Assistant Director for Business and Industry Programs for the Pacific Earthquake Engineering Research Center.



### Treasurer

### Kalman Lee Benuska

Lee Benuska is a structural engineer whose thirty years experience covers a broad range of projects in the analysis, design and seismic risk assessment of structures in California. His past affiliations include Principal at Lindvall Richter Benuska Associates, General Manager of Kinometrics, Inc., and Associate at T.Y. Lin and Associates. He has participated in the design and construction supervision of more than \$400 million of building construction. He has also served as earthquake design consultant for various apartment, office and hotel buildings, and conducted research studies for the U.S. Dept. of Defense and the Federal Housing Administration.



### Past President

### James Beck

James Beck is Professor of Applied Mechanics and Civil Engineering, and Executive Officer for these departments, at Caltech. Jim has broad research interests in earthquake engineering and structural dynamics, and he currently supervises seven doctoral students in these areas. He is in his second term as an At-Large Director of the CUREe Board. Jim has participated in all three phases of the CUREe-Kajima Research Program and is currently a member of the Phase III Project Team in charge of Decision Support Tools for Earthquake Recovery of Businesses. His e-mail address is: jimbeck@cco.caltech.edu. He also wishes to remind CUREe members that their Board welcomes new ideas from the membership for possible projects which are appropriate to CUREe's mission.

## Share Experiences with the Woodframe Project

The CUREe/Caltech Woodframe Project, recently funded by the Federal Emergency Management Agency through the California Governor's Office of Emergency Services to develop reliable and economical ways to improve the earthquake performance of woodframe construction, is seeking written points of view on any aspect of this subject. Potential topics include, but are not limited to, the following:

### 1. Testing and Analysis

- a. Testing protocols and methods (standardization, appropriate loading protocols for different purposes, test set-ups, instrumentation)
- b. Types of tests needed (by component or type of data)
- c. What current analytical methods are best and what is needed?
- d. Other on-going research programs (facilities, goals, accomplishments)

### 2. Field Investigations

- a. Conversion of observed damage into loss measures (repair cost, casualties, disruption) or performance levels (distinction between safety and other goals)
- b. Construction quality and its importance relative to adequacy of design and code provisions
- c. Sources of statistical information or ways to obtain it
- d. Differences among small residential (houses, duplexes), large residential (apartments, condominiums), and other woodframe construction (schools or commercial)

### 3. Building Codes and Standards

- a. Needed code changes
- b. Role of inspection
- c. Appropriateness of conventional vs. engineered construction
- d. California vs. other states' needs
- e. Design philosophy underlying codes: Can a rational basis be developed for wood in terms of an intended sequence of damage/inelasticity and consideration of dynamic properties?
- f. Practical issues in improving and adopting codes
- g. Integrating materials standards and building code engineering provisions

### 4. Economic Aspects

- a. Insurance needs: pre-earthquake ratings, post-earthquake repair
- b. Housing impacts
- c. Real estate issues (e.g. disclosure)
- d. Cost implications of exceeding minimum code requirements in order to enhance earthquake performance

### 5. Education and Outreach

- a. Needs of specific audiences (engineers, architects, building officials, builders, general public)
- b. Methods and media which are most effective
- c. Topics that should be covered (new design vs. retrofit vs. post-earthquake repair; conventional vs. engineered; residential vs. non-residential)

Goals of this request are to collect a wide variety of comments dealing with important aspects of earthquakes and wood buildings and to provide individuals, companies, and organizations the chance to express their viewpoints. Of particular interest are experiences about deficiencies in the status quo. The CUREe-Caltech Woodframe Project will utilize the information gathered in its planning process, and will publish a compilation of the comments in original form during 1999.

Contributions which promote particular proprietary products or services will be circulated for review among the Project Committee but will not be published. Detailed descriptions of earthquake damage of actual buildings should not be submitted at this time, because these will be the subject of a future solicitation. Please send by May 3, 1999 to the Project Manager of the CUREe-Caltech Woodframe Project: Prof. John F. Hall, Mail Code 104-44, Caltech, Pasadena CA 91125. Diskette, e-mail or paper submittals are acceptable. Contributions exceeding 8 pages should receive prior consent. Illustrations and photographs may also be included. For correspondence and submission by e-mail, use [johnhall@its.caltech.edu](mailto:johnhall@its.caltech.edu).

CUREe members automatically receive the Woodframe Project Newsletter, which others may receive at no charge by sending their name, address, telephone, fax, and e-mail information to the CUREe office.

## 1998 CUREe Annual Meeting

A successful Annual Meeting of CUREe was held on Saturday, November 7, 1998 at the Wyndham Hotel in Los Angeles. CUREe Secretary, Jim Anderson, took the lead role in organizing the Program. A brief business meeting was held, then presentations were made by project managers for several CUREe research projects and by younger faculty and graduate students on their research. The Annual Meeting proceedings, which contain abstracts of the presentations, show an impressive range of research being carried out in earthquake engineering in the universities belonging to CUREe.

Several important actions were taken by the CUREe Board at its November 6th meeting that warrant repeating here with some slight updating:

1. The CUREe officers for 1999 are: Karl Romstad (President), Gerard Pardoen (Vice-President), Gregory Fenves (Secretary), K. Lee Benuska (Treasurer) and James Beck (Past-President).

2. A resolution was passed unanimously that "The Board resolves to develop a strategy to implement the opening of CUREe membership to any research university in the USA with demonstrated interest in, and contribution to, the field of earthquake engineering, with the approval of the Board." As a result, then-President Beck appointed a Strategic Planning Committee with the charge to prepare a plan for opening CUREe to wider membership.

During the business meeting, former CUREe Treasurer, Chia-Ming Uang, presented data showing that CUREe is in good financial health. Current funded research programs have a total budget exceeding \$9 million, with more than half of this amount coming from the three-year Woodframe Project funded by FEMA this September. In addition to those forming part of the initial team that developed the

Woodframe Project proposal, there will be opportunities for other CUREe members to get involved in specific tasks of this project through mechanisms similar to those used in the SAC Steel Project.

Finally, some recent CUREe activities were mentioned which highlight additional benefits of CUREe membership beyond the opportunities to participate in large funded projects. These activities include the CUREe International Lectureship for supplementary funding of overseas travel; the sponsorship of graduate students from CUREe member universities to attend national conferences and symposia; the then upcoming CUREe-SCEC Course on the Earth Sciences-Engineering Interface in Seismic Design (a well-attended meeting which was held on November 30th); and the CUREe-SEAOC Seminars on Structural Engineering. Several of these activities will be reviewed in more detail in the next issue of the CUREe Newsletter.

### Staff Changes at CUREe



**Parshaw Vaziri** was recently promoted to Associate Executive Director. Parshaw began working for CUREe in 1992, under the supervision of CUREe's Secretary at that time, Professor Stephen Mahin. Initially contracted to CUREe through the University of California at Berkeley, he began working directly for CUREe in the Fall of 1994. He is looking forward to the challenges of his new position, and is eager to help with CUREe's continued growth.

**Carol Cameron**, our new Publications Coordinator, was hired January 1st. Carol comes to us from the Pacific Earthquake Engineering Research Center, where she was a Senior Editor. Prior to that, she was an editor with Reed Travel Group in Boston, and with the University of New Mexico in Albuquerque.



## President's Column

*continued from page 1*

The successful launching of PEER has required that CUREe assess what direction it should take for the future. Some members worry that CUREe may be in competition with PEER and hence that this may tend to split the community. I am convinced that CUREe is needed and will cooperate effectively with PEER. CUREe, as a private corporation, has a flexibility that a university-based organization cannot have. As a private, well funded, professional organization with a highly competent staff, CUREe has shown that it can respond nimbly and quickly to opportunities when they develop and bring together academics and professionals for efforts supported by private and public agencies in the US and abroad. Efforts which CUREe has shown itself to be particularly well suited for fall between the more fundamental long-term research efforts suited to Centers and individual faculty, on the one hand, and the very applied efforts of professional organizations, on the other.

Over the near term, CUREe will continue its ongoing and new research and educational programs. The Woodframe project is just getting underway, and will involve many CUREe members working side by side with professionals in the private and public sectors. CUREe will continue developing innovative multi-university research and applications program proposals directed toward critical national and international needs. Any CUREe member with ideas for such programs should contact their CUREe representative to see how to get these ideas implemented. Your ideas are welcome on any matter. In fact, it is critical to CUREe's future that recent faculty additions at the member campuses become more knowledgeable of, and deeply involved in, CUREe activities.

The CUREe Board of Directors believes that CUREe should seriously explore the feasibility of becoming a national organization, and Past President Jim Beck appointed a committee to "develop the strategy to implement the opening of CUREe membership to any research university in

the United States, with an interest in, and contribution to, the field of earthquake engineering, with the approval of the Board." There are several reasons the Board believes the idea has merit. It is believed that a national organization could more effectively 1) respond to research opportunities immediately after an earthquake, 2) respond to international research collaborations, 3) respond to large-scale federal initiatives with respect to research facilities and information/data linking, and 4) speak nationally with a sharp focus on behalf of pressing earthquake engineering research needs. Each of the three current Centers has a regional focus. As a nationally representative, university-based, private organization, CUREe (Cooperating Universities for Research in Earthquake Engineering?) could work with all the contributing earthquake engineering research and professional communities in the United States.

We welcome Joel Conte (UCLA), Stephanie King (Stanford), Yan Xiao (USC), Armen Der Kiureghian (UC Berkeley), and André Filiatrault (UC San Diego) as new members of the Board of Directors. We are also pleased to announce the promotion of Parshaw Vaziri to Associate Executive Director of CUREe to support Executive Director Bob Reitherman as CUREe activities continue to grow, and the appointment of Carol Cameron as Publications Coordinator with responsibility for all CUREe publications including website tasks. An additional full-time and two part-time student staff positions are also being filled.

Finally, CUREe extends its deepest appreciation to retiring members of the Board of Directors Jim Anderson (USC), Jim Beck (Caltech), Steve Mahin (UCB), Geoff Martin (USC) and Chia-Ming Uang (UCSD). Each of these individuals has unselfishly devoted a great deal of their time to CUREe and served as officers and members of the Executive Committee. I am confident we will have to call on them in the future for their advice and they will willingly give it.

## The CUREe-SEAOC Seminars on Structural Engineering

CUREe and SEAOC began in 1998 a series of seminars to present practitioner and academic viewpoints on structural engineering to university students. Topics addressed by the SEAOC practicing engineers involved in these seminars include the job-related attributes that engineering offices look for in graduating students and the types of career development opportunities available in the profession of structural engineering today. The professor participants in these seminars discuss the philosophy underlying the civil engineering education provided to today's students, who are the future engineers who will be practicing or teaching in the 2000-2050 timeframe.

Four seminars were held in 1998. Speakers included James Malley (Degenkolb Engineers) Helmut Krawinkler (Stanford University), Scott Stedman (Stedman and Dyson), Gary Hart (UCLA), Gregg Brandow (Brandow and Johnston Associates), and Gregory Deierlein (Stanford University).

The scheduled seminars for 1999 will be announced shortly. The following pamphlets on CUREe-SEAOC Seminars, *Information on Memberships to Professional and Technical Societies*, *Information of Civil Engineering Graduate Programs at CUREe Member Universities*, and *Quotations and Excerpts from Past Seminars*, are available from the CUREe office.

## Effects of Near-Field Ground Motion on Long-Period Structures

by Professor Helmut Krawinkler  
Stanford University

*Professor Helmut Krawinkler is the lead researcher for CUREe in the CUREe-Kajima Joint Research Program project on near-field ground motion. This article summarizes this in-progress work.*

Near-field ground motions include large pulses that may greatly amplify the dynamic response of long period structures, particularly if structures are called upon to respond inelastically to earthquake ground motion. Pulses will amplify the maximum interstory drift for elastic structures, and more so for inelastic structures. The amplified interstory drifts may impose excessive deformation demands on elements, which in turn may lead to incremental (P-delta) collapse.

Thus, the need exists for focused research to improve our understanding of near-field ground motions and their effects on structures. As part of the CUREe-Kajima research program, four projects are in progress or are planned, with the focus on the following objectives:

- Identify and quantify characteristics of near-field ground motions,
- achieve an understanding of the effects of large pulses on the response of elastic and inelastic flexible structures,
- quantify the seismic demands imposed by near-field ground motions on flexible structures, and
- develop techniques for improving the response of flexible structures to near-field ground motions.

Each project has a CUREe component and a Kajima component. Only the CUREe components are summarized here.

**Project #1. Characterization of Near-Field Ground Motions, PI Professor T. Heaton, Caltech.** This one-year project, which is nearing completion, is concerned with the estimation of near-field ground motions from historic crustal earthquakes in Japan. Preliminary estimates indicate that near-source ground displacements in some of the past Japanese earthquakes (1891 Mino-Owari and 1927 Tango earthquakes) were significantly larger than in the 1995 Kobe earthquake.

**Project #2. Effects on Long Period Building Structures and Design Issues, PI Professor Helmut Krawinkler, Stanford.** This three-year project is partially completed. It focuses on the response of elastic and inelastic SDOF and MDOF structural systems to various pulses and near-

field ground motions. Bilinear and degrading structural systems are being analyzed, and the responses are evaluated for localized demands (plastic hinge rotations), story drift demands, global displacement demands, and energy demands. The emphasis is on a variation of structural characteristics, including strength and stiffness properties, failure mechanisms, and strength, stiffness, and mass irregularities in elevation. Particular emphasis is being placed on an evaluation of dynamic P-delta effects which may lead to incremental collapse when individual story drifts get amplified due to the pulse-type nature of near-field motions.

**Project #3. Performance Improvement of Long Period Building Structures, PI Professor James Anderson, USC.** This one-year project is just starting. It is concerned with performance improvement considering conventional and innovative approaches, ranging from the addition of walls or bracing systems to the employment of various types of passive energy dissipation devices. Nonlinear time history analysis will be utilized to evaluate various improvement techniques.

**Project #4. Performance of Long-Span Highway Overpasses, PI Professor John Wallace, UCLA.** This one-year project is underway. It is concerned primarily with response evaluation and improvement of long-span continuous rigid frame bridges. Both simplified and more detailed analytical models will be developed and analyzed. Parametric studies using the simplified models will be performed to address important response characteristics and to identify areas where more detailed models are needed.

At this time the projects have not progressed far enough to draw strong and quantitative conclusions. Many findings noted by others have been confirmed, and new but preliminary findings have been discovered. These preliminary findings can be summarized as follows:

- The pulse-type characteristics of many near-field ground motions can be identified in the time history traces of velocities and displacements, in the shape of the response spectra, and in other spectral quantities such as the normalized hysteretic energy,  $HE/F_y d_y$ .
- In many aspects the response of structures to pulse inputs differs greatly from that to standard ground mo-

tions. For elastic structures with a fundamental period  $T$  equal to or exceeding the pulse period  $T_p$ , the story shear force distribution over the height is sensitive to the ratio  $T/T_p$  and may cause shear forces in middle or upper stories that are higher than the base shear. Unless this is considered in strength design, these middle or upper stories will yield prematurely. On the other hand, for structures of low strength in which the ductility demands are high, the largest ductility demands migrate to the bottom stories of the structure. This is illustrated in *Figure 1*, which shows ductility demands over the height for strong ( $g = 0.75$ ) and weak ( $g = 0.25$ ) structures with  $T/T_p = 1.0$ .

- In many period ranges (not only for  $T/T_p > 1.0$ ) the P-delta effect plays a critical role. Ductility demands may be greatly amplified if any story attains a negative post-yield stiffness due to P-delta, even if the negative slope is only a small fraction of the initial elastic stiffness.
- Work is in progress to relate near-field ground motion characteristics to the characteristics of basic pulses so that advantage can be taken of general information derived from detailed response studies of SDOF and MDOF systems subjected to pulse inputs. Matching of ground motion spectra with pulse spectra often permits the identification of the pulse type and period that define the characteristics of the ground motion. In this manner, the seismic demands imposed by near-field ground motions can be described by demands of equivalent pulses. This is illustrated in *Figure 2*, which shows, for a specific ground motion (NF05) and its equivalent pulse (P2), the relationship between maximum ductility demand and base shear strength for MDOF structures with a fundamental period equal to the period of the equivalent pulse.
- For structures that are designed according to present design procedures (without regard to near-field effects) the ductility demands will vary greatly over the height of the structure and will be quite different from the demands imposed by standard ground motions. A modified design approach is needed for flexible structures in regions in which near-field ground motions dominate the seismic hazard. This problem cannot be solved effectively by applying a near-field factor to the base shear and using the same shear force distribution over the height as is used in present design procedures.

## Lysmer Dies at Age 67

We regret to announce the passing of one of CUREe's members. Professor John Lysmer died suddenly January 25th at his home in Berkeley at the age of 67. Lysmer was a professor emeritus of civil and environment engineering at UC Berkeley, where he joined the faculty in 1965.

## New Institutional Reps Selected

The following individuals have been selected as CUREe Institutional Representatives: Professor André Filiatrault, UC San Diego; Professor Armen Der Kiureghian, UC Berkeley; and Professor Yan Xiao, USC. They replace Professors Chia-Ming Uang, Stephen Mahin, and Geoffrey Martin, respectively.

## New Web and E-mail Addresses

The new address for the CUREe website is  
<http://www.curee.org>  
 Our new e-mail address is:  
[curee@curee.org](mailto:curee@curee.org)

New staff e-mail addresses are listed on page one.

## Publications

The 1999 CUREe Calendar is available for \$10.

The four-volume *Proceedings of the NEHRP Conference and Workshop on Research on the Northridge, California Earthquake of January 17, 1994* is now on sale for \$195.

For a copy of CUREe's Publications Brochure, please contact the CUREe office.

Look for the second edition of the Woodframe Project Newsletter, which will be available soon.

## New CUREe Members

The following individuals have been approved as new members of CUREe:

Joel Conte	UCLA
Gregory Deierlein	Stanford University
André Filiatrault	UC San Diego
Laura Lowes	Stanford University
Simon Wilkie	Caltech

## CUREe Board of Directors

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FEBRUARY 12, 1999

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