

# MINUTES

## Meeting of the Committee on Optimal Structural Design

19 April 1999, 2:30-8:30pm  
1999 Structures Congress & Exposition  
Sheraton Hotel, New Orleans, Louisiana USA

In attendance were: *Don Grierson (chairperson), Jasbir Arora, Rick Balling, Scott Burns, Franklin Cheng, Dan Frangopol, Hitoshi Furuta, Santiago Hernandez, Mircea Iordanescu, Siavash Khajepour, Warren Lucas, Akinokiri Matsuho, Makoto Ohsaki, Shahram Pezeshk, Colby Swan.*

### Call to Order

The meeting was called to order at 2:35 p.m. by Don Grierson, who presided over the meeting. All members and guests in attendance were introduced. Minutes from the preceding meeting of the committee (20 July 1998, San Francisco) were approved, and there was no new business arising from these minutes.

### Review and Update of Committee Membership

Members of the Control Group for the OSD Committee were identified as Franklin Cheng, Dan Frangopol (past-chair), Don Grierson (chair), and Colby Swan (secretary). In response to ASCE's request that two members be designated as spokespersons for the OSD Committee, Don Grierson and Scott Burns were appointed.

It was noted that the following member's terms on the OSD Committee will expire in 1999 due to ASCE's term limits: Arora, Balling, Burns, Frangopol, Pezeshk, and Rajan. The chair noted that unless these members request an extension, their OSD Committee memberships will terminate this year. Members retiring from the committee were asked to recruit new members, who must be or become members of ASCE.

### Report on Journal of Structural Engineering

Scott Burns, whose three-year term as one of three Associate Editors is due to expire this year, announced that he will be succeeded in October 1999 by Shahram Pezeshk. Scott Burns made the following points regarding the Journal of Structural Engineering:

- During his tenure, the acceptance rate for optimization related manuscripts was 46%, which is very close to the 45% overall acceptance rate for the journal itself.
- During the past year, the journal received 312 manuscripts. These included 58 on Analysis and Computations (13 on structural optimization); 72 on concrete and masonry; 77 on structural metals; and the remainder on other topics.
- For those accepted, the average time from submission to publication was ten months.
- The editors of the journal are encouraging the submission of more manuscripts, and also theme issues of the journal.

## Report on Sponsored Conference Sessions

For the 1999 Structures Congress, the OSD sponsored/organized one and a half technical sessions. Shahram Pezeshk organized a session on *Use of Genetic Algorithms in Structural Engineering*, and Colby Swan organized a session (shared with the Committee on Emerging Computing Technologies) on *Advanced Technologies in Conceptual Design of Structures*.

For the 2000 Structures Congress in Philadelphia, Jasbir Arora announced that fifteen Analysis and Computations session proposals were submitted. Of these, nine sessions were approved and will form an Analysis and Computations sub-track at the 2000 Structures Congress. Four additional session proposals were approved as condensed sessions, and transferred to the General Track at the 2000 Structures Congress.

The three approved sessions proposed by the OSD Committee are:

1. Don Grierson in cooperation with Chun Man Chan and Xu Lei is organizing a session on *Optimal Performance-Based Design of Buildings*. While six papers for the session are desired (split evenly among practitioners and academicians), three papers have been confirmed thus far.
2. Scott Burns is organizing a session on the *State of the Art in Structural Optimization*. Six speakers have agreed to submit papers and give presentations on such topics as: aero-elastic optimization, whole-life structural optimization, structural optimization using discrete variable techniques, evolutionary structural optimization, and multi-objective optimization.
3. Dan Frangopol is organizing a session on *Case Studies in Optimal Design of Structural Systems*. Five papers/presentations are desired, and two have been confirmed thus far.

It was noted that for all three of these sessions, organizers must submit abstracts to ASCE by 1 June 1999, and manuscripts will be due 1 November 1999.

## Report on State of Art Publication

Scott Burns briefed the committee on topics that have been proposed (some with abstracts) for the publication presently under consideration. These are the following:

1. Conceptual Design Optimization of Engineering Structures. This contribution would be organized by Don Grierson, and would emphasize optimization of structures from a life-cycle cost and revenue generation perspective. Potential contributors (in addition to Don) are Lynn Moor and Ian Parmee.
2. Multi-objective Optimization, organized by Franklin Cheng. This contribution would cover topics such as: structures with multiple material systems (such as steel and concrete), control and response of structures, life-cycle cost, and basic methods of multi-objective optimization.
3. Optimization of Bridges with Aeroelastic Constraints headed up by Santiago Hernandez, with emphasis on wind forces, wind response characteristics, optimization, and design-sensitivity analysis (DSA).
4. Structural Topology Optimization by Colby Swan and Makoto Ohsaki, including both ground-structure and continuum topology optimization techniques.
5. Structural Decomposition Methods by Rick Balling, with applications to both analysis and optimization.
6. Genetic Algorithms by Shahram Pezeshk.

7. Discrete Variable Optimization by Jasbir Arora, with emphasis on methods and applications.
8. Combined Structural Analysis and Design by Scott Burns.
9. Optimization of Bridges for Whole Lifecycle Cost by Dan Frangopol.
10. Optimization of Tall Building Structures by Chun-Man Chan.
11. Design Optimization of Semi-Rigid Framed Structures by Lei Xu. (Frank Cheng suggested that W-F. Chen be invited to contribute on this topic.)

Additional topics relevant to civil engineering structures that were recognized as not covered in the above list were: Nonlinear DSA; and Structural Reliability.

A number of possible options for publication of this State of the Art Volume were discussed, including:

- a. Publication as a stand-alone manual of practice by ASCE;
- b. Publication of the listed contributions as a theme issue in the Journal of Structural Engineering. This implication of this option is that each contribution would constitute a separate article having to undergo an independent peer review process.
- c. Publication of the document as a report by the committee, and in abridged form in the Journal of Structural Engineering. The report would need to be reviewed by an ASCE Executive Committee.

After some discussion, it was agreed that option “c” will be pursued. Scott Burns, Dan Frangopol and Don Grierson will draft both an outline and an editorial which will accompany the report. All contributors will submit a first draft of their sections by 21 September 1999. The committee agreed that all documents will be submitted electronically via the internet.

### **Structural Optimization Data Base**

Scott Burns gave a demonstration and explanation to the committee on the data base he has created on research publications pertaining to structural optimization. CD's with the most recent data base were distributed to committee members.

### **2001 Structures Congress**

Technical session proposals for the 2001 Congress to be held 21-23 May 2001 in Washington D.C. were discussed. Guidelines for development of session proposal can be obtained at [www.asce.org/conferences/structures2001](http://www.asce.org/conferences/structures2001). The following were discussed as possible session proposals, and the development of other proposals was encouraged:

- a. Performance-Based Structural Optimization by Grierson and Swan;
- b. State of the Art Manual Report by Burns.
- c. Applications in Structural Optimization by Hernandez.

Session proposals are due to Jasbir Arora by 5 November 1999.

### **New Directions for the OSD Committee**

The chair initiated a discussion on possible new directions for the committee. The observation that structural optimization has not taken strong hold in the civil-structural community was discussed. It was noted that there are barriers to usage of structural optimization among practitioners. In addition, it was mentioned that the term “optimization” has often come to be associated with the pursuit of least-cost structures, whereas structural engineers are interested in not just least cost but also the performance characteristics of structures under a wide range of loading conditions. It was noted that the applicability of structural optimization to performance-based design should be more strongly emphasized through specialty conferences which address problems of current interest in the structural engineering community. An example mentioned was the one-day workshop on Optimal Design of Civil Infrastructure Systems organized by Dan Frangopol at the 1997 Structures Congress.

While no firm conclusions were drawn, it was agreed that discussion on this topic will continue at future meetings.

### **Announcements**

- The Emerging Computing Technology Committee has been requested to develop a website for the Optimal Structural Design Committee.
- The 2002 Structures Congress will be held in Denver.
- Committee members with new are urged to send items to Colby Swan (Secretary), who will then forward the information to ASCE News.
- Franklin Cheng has been invited by the Tall Building Council to initiate a monograph on optimization of tall structures. The monograph will be published by McGraw-Hill. He solicits contributions from committee members who would like to part of the effort.

### **Adjournment**

The meeting was adjourned at 6:00pm, following which members regrouped for continued discussions and dinner on the town in New Orleans.

Respectfully submitted,

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