



# 2019 SSRC ANNUAL STABILITY CONFERENCE

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## sessions

### Advances in Stability Analysis

**S1** Wednesday 8:00 a.m. – 9:00 a.m.

Moderator: Ronald D. Ziemian,  
Bucknell University

#### **Welcome to the 2019 SSRC Annual Stability Conference**

Todd A. Helwig, University of Texas at Austin, Austin, TX

#### **Accurate Direct Strength Method (DSM) Prediction of Column Flexural-Torsional Failure Loads**

Pedro B. Dinis and Dinar Camotim, University of Lisbon, Lisbon, Portugal; Alexandre Landesmann, COPPE - Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

#### **Design by Advanced Elastic Analysis - An Investigation of Beam-Columns Resisting Minor-Axis Bending**

Yunfei (Phoebe) Wang, Cornell University, Ithaca, NY; Ronald D. Ziemian, Bucknell University, Lewisburg, PA

#### **Application of Geometrically Exact Beam Finite Elements in the Advanced Analysis of Steel and Steel-Concrete Beam-Columns**

Rodrigo M. Gonçalves, Guilherme M. C. O. Carvalho, José T. O. P. de Silveira, and Manuel J. L. de Sousa, Nova University of Lisbon, Lisbon, Portugal

#### **Validation Study of a New Inelastic Material Model for Steel W-Shapes**

Barry T. Rosson, Florida Atlantic University, Boca Raton, FL; Ronald D. Ziemian, Bucknell University, Lewisburg, PA

Engineers

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### Stability of Beams and Girders

**S2** Wednesday 9:15 a.m. – 10:15 a.m.

Moderator: Anjan K. Bhowmick,  
Concordia University

#### **Torsional Bracing Requirements on the Stability of Steel I-Girders**

Yangqing Liu, Tongji University, Shanghai, China; Todd A. Helwig, University of Texas at Austin, Austin, TX

#### **Large-scale lateral-torsional buckling tests of welded girders**

Xiao Lin Ji, Robert G. Driver, and Ali Imanpour, University of Alberta, Edmonton, Canada

#### **On the Interaction Between Local and Lateral-Torsional Buckling of I-Shaped Slender Section Beams**

Carlos Couto, Bruno Madureira, and Paulo V. Real, RISCO University of Aveiro, Aveiro, Portugal

#### **Distortional Buckling Behavior and Design Consideration of Castellated Steel Beams Considering Residual Stresses**

Xuhong Zhou, Ziqi He, Peng Chen, and Jingchao Li, Chongqing University, Chongqing, China; Zhanjie Li, SUNY Polytechnic Institute, Utica, NY

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## Stability under Seismic Loading

**S3** Wednesday 1:30 p.m. – 3:00 p.m.

Moderator: Matthew R. Eatherton, Virginia Tech

### Seismic Performance Assessment of Special Concentrically Braced Frames in a Moderate Seismic Region

Kelley D. M. Grabner, KPFF, Seattle, WA; Larry A. Fahnestock, University of Illinois at Urbana-Champaign, Urbana, IL

### Seismic Performance of Corrugated Double-Skin Composite Shear Walls with Different Aspect Ratios

QiuHong Zhao and Yikang Li, Tianjin University, Tianjin, China; Ying Tian, University of Nevada, Las Vegas, NV

### Seismic Performance and Impact of Geometric Nonlinearity on 3D Steel Braced Frame Building Models

Hamid Foroughi and Benjamin W. Schafer, Johns Hopkins University, Baltimore, MD; Gengrui Wei and Matthew R. Eatherton, Virginia Tech, Blacksburg, VA

### Design of Fixed-Base Hollow Structural Section Subjected to Large Seismic Drift

Hyeeun Kong and Matthew R. Eatherton, Virginia Tech, Blacksburg, VA; Benjamin W. Schafer, Johns Hopkins University, Baltimore, MD

### Uncertainties in Collapse Analysis of Framed Structures Due to Seismic Excitation

Kevin K.F. Wong, National Institute of Standards and Technology, Gaithersburg, MD

### Stability Evaluation of Cold Formed Steel Pallet Racks under Seismic Condition – A Numerical and Shake Table Study

Arul Jayachandran Sanjeevi, Indian Institute of Technology, Chennai, India

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## Presentation Session for Beedle and McGuire Awards

**S4** Wednesday 3:15 p.m. – 4:45 p.m.

Moderator: Todd A. Helwig, University of Texas at Austin

### Beedle Award Presentation: A Stability Journey – Diaphragms, Cold-Formed Steel and the SSRC

W. Samuel Easterling, Virginia Tech, Blacksburg, VA

### MAJR Medal Presentation: Ten Years of Stability of Structural-Steel Research: The Hot, the Cold, and the Ugly

Mina Seif, National Institute of Standards and Technology (NIST), Gaithersburg, MD

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## Stability at Elevated Temperatures

**S5** Wednesday 5:00 p.m. – 6:00 p.m.

Moderator: Mina Seif, National Institute of Standards and Technology (NIST)

### Influence of Simple Connection Restraint on the Lateral-Torsional Buckling Behavior of Restrained Beams under Fire Conditions

Erica C. Fischer, Oregon State University, Corvallis, OR

### Time-Dependent Buckling of Steel Plates Exposed to Fire

Mohammed A. Morovat, Michael D. Engelhardt, and Todd A. Helwig, University of Texas at Austin, Austin, TX

### Comparison of Steady-State and Transient Thermo-Mechanical Responses of Unprotected Aluminum Columns at Elevated Temperatures

Jean C. Batista Abreu and Tyler D. Spinello, Elizabethtown College, Elizabethtown, PA; Nicholas A. Soares and Ronald D. Ziemian, Bucknell University, Lewisburg, PA

### Evaluating Critical Temperatures of Axially Loaded I-Shaped Steel Members Using ANSI/AISC-360 Appendix 4

Ana Sauca, Chao Zhang, Mina Seif, and Lisa Choe, National Institute of Standards and Technology (NIST), Gaithersburg, MD

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## Stability Considerations for Localized Conditions

**S6** Thursday 8:00 a.m. – 9:00 a.m.

Moderator: Kara D. Peterman,  
University of Massachusetts  
Amherst

### **Web Compression Buckling Strength of Wide Flange Members: On the Influence of Bearing Length**

Kadir C. Sener and Amit H. Varma, Purdue University, West Lafayette, IN

### **The Impact of Bearing Conditions on the Stability Behavior of Cold-Formed Steel Stud Assemblies**

Abbas Joorabchian and Kara D. Peterman, University of Massachusetts Amherst, Amherst, MA; Zhanjie Li, The SUNY Polytechnic Institute, Utica, NY

### **Compression Capacity of Short Cold-Formed Steel Built-Up Columns with Double Lacing Configuration and Low Sectional Compactness**

M. Adil Dar, Dipti Ranjan Sahoo, and Arvind K. Jain, Indian Institute of Technology Delhi, New Delhi, India

### **Influence of the Length of Patch Load on the Ultimate Load of Longitudinally Stiffened Plate Girders**

Sasa Kovacevic, Washington State University, Pullman, WA; Nenad Markovic, University of Belgrade, Belgrade, Serbia

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## Stability of Plates and Shells

**S7** Thursday, 9:15 a.m. – 10:15 a.m.

Moderator: Simos Gerasimidis,  
University of Massachusetts  
Amherst

### **Influence of Boundary Conditions on the Shear Post-Buckling Behavior of Thin Web Plates**

Spencer E. Quiel and Kevin Augustyn, Lehigh University, Bethlehem, PA; Maria E. Moreyra Garlock and Peter Wang, Princeton University, Princeton, NJ

### **Design of Archetype 3-MW Spirally Welded Wind Turbine Tower**

Abdullah Mahmoud, Shahbeddin Torabian, and Benjamin W. Schafer, Johns Hopkins University, Baltimore, MD; Angelina Jay, Fariborz Mirzaie, and Andrew Myers, Northeastern University, Boston, MA; Eric Smith, Keystone Tower Systems, Westminster, CO

### **Imperfection Insensitive Thin Steel Tubular Shells under Bending**

Kshitij Kumar Yadav and Simos Gerasimidis, University of Massachusetts Amherst, Amherst, MA

### **Analytical and Numerical Buckling Analysis of Rectangular Functionally-Graded-Material Plates under Uni-Axial Compression Load**

Elias Ali and Yared Shifferaw, Drexel University, Philadelphia, PA

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## Stability of Connections and Assemblages

**S8** Thursday, noon – 1:00 p.m.

Moderator: Cliff D. Bishop,  
Exponent, Inc.

### **Stability of Apex Connections in Cold-Formed Steel Portal Frames**

Hannah B. Blum, University of Wisconsin-Madison, Madison, WI; Zhanjie Li, SUNY Polytechnic Institute, Utica, NY

### **Buckling of Unstiffened Extended Shear Tab Connections**

Mohammad Motallebi and Colin A. Rogers, McGill University, Montreal, Canada; Dimitrios G. Lignos, Swiss Federal Institute of Technology, Lausanne (EPFL), Lausanne, Switzerland

### **Topology Optimization of Steel Shear Fuses to Resist Buckling**

Javier A. Avecillas and Matthew R. Eatherton, Virginia Tech, Blacksburg, VA

### **Modal Buckling Analysis of Trapezoidal Sheeting**

Sandor Adany, Budapest University of Technology and Economics, Budapest, Hungary

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## Topics in Lateral-Torsional Buckling

**S9** Thursday 2:00 p.m. – 3:30 p.m.

Moderator: Lakshmi Subramanian,  
Indian Institute of Technology  
Madras

### **Moment Gradient Factor for Lateral-Torsional Buckling of T-Shaped Beams**

Michael Manarin, Robert Driver and Yong Li, University of Alberta,  
Edmonton, Canada

### **Moment Gradient Factors for Singly-Symmetric I-Sections**

Matt Reichenbach, Todd A. Helwig, and Michael D. Engelhardt, University of  
Texas at Austin, Austin, TX; Yangqing Liu, Tongji University, Shanghai, China

### **Experimental Study on the LTB Resistance of Trapezoidally Corrugated Web Girders**

Bence Jáger, Balázs Kövesdi, and László Dunai, Budapest University of  
Technology and Economics, Budapest, Hungary

### **A Modified Approach Towards Estimating The Lateral Torsional Buckling Effective Length**

Joel Ben John and Lakshmi Subramanian, Indian Institute of Technology  
Madras, Chennai, India

### **Strength and Stability of Point-Symmetric Cold-Formed Steel Members Undergoing Lateral-Torsional Buckling**

Samuel Baer and Benjamin W. Schafer, Johns Hopkins University, Baltimore,  
MD; Robert Glauz, RSG Software, St. Louis, MO

### **Lateral Stability and Design of Gerber Systems**

Amir Elmaraghy, Kévin Silva, Valentin Manaud, and Nicolas Boissonnade,  
Laval University, Québec City, Canada

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## Topics in Local Stability

**S10** Thursday 4:00 p.m. – 5:30 p.m.

Moderator: Perry Green, Bechtel  
Corporation

### **Issues of Scale on Experimental Buckling Results for Circular Steel Tubes in Bending**

Angelina Jay, Exponent Inc., New York, NY; Andrew T. Myers, Northeastern  
University, Boston, MA; Benjamin W. Schafer, Johns Hopkins University,  
Baltimore, MD

### **Experiments and Computations on Steel Bridge Corroded Beam Ends**

George Tzortzinis, Brendan Knickle, Simos Gerasimidis, and Sergio Breña,  
University of Massachusetts Amherst, Amherst, MA; Alexander Bardow,  
Massachusetts Department of Transportation, Boston, MA

### **Experimental and Numerical Investigation of Local Stability of Flexural Cold Formed High Strength Steel Hollow Section Profiles**

Ieva Misiunaite, Ronaldas Jakubovskis, Aleksandr Sokolov, Arvydas Rimkus,  
and Viktor Gribniak, Vilnius Gediminas Technical University, Vilnius, Lithuania

### **Structural Stability Condition Assessment of Corroded Steel Trusses in Operating Industrial Facilities**

Hunter Brown, Martin/Martin Consulting Engineers, Lakewood, CO; Damon  
G. Reigles, Structural Technologies, Columbia, MD; Perry Green, Bechtel  
Corporation, Reston, VA

### **Local Buckling of SHS Members with Moderate-to-Large Corner Radii under Combinations of Axial Force and Biaxial Bending**

Luís Vieira and Dinar Camotim, University of Lisbon, Lisbon, Portugal;  
Rodrigo M. Gonçalves, Nova University of Lisbon, Lisbon, Portugal

### **The Role of Local Buckling in the Determination of H.S.S. Rotational Capacity**

Elsy Saloumi and Marielle Hayeck, University of Applied Sciences of Western  
Switzerland – Fribourg, Fribourg, Switzerland; Joanna Nseir, Saint-Joseph  
University, Beirut, Lebanon; Nicolas Boissonnade, Laval University, Québec  
City, Canada

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## Stability of Columns

**S11** Friday 8:00 a.m. – 9:00 a.m.

Moderator: Dinar Camotim,  
University of Lisbon

### **Post-Buckling Behavior of Thin-Walled Regular Polygonal Tubular Columns Undergoing Local-Distortional Interaction**

André D. Martins and Dinar Camotim, University of Lisbon, Lisbon, Portugal;  
Rodrigo M. Gonçalves, Nova University of Lisbon, Lisbon, Portugal

### **Characterization of the Monotonic and Cyclic Collapse Behavior of Built-Up CFS Columns**

Smail Kechidi and José M. Castro, University of Porto, Porto, Portugal;  
Benjamin W. Schafer, Johns Hopkins University, Baltimore, MD

### **Stiffness Matrix for Buckling Analysis of Tapered Steel Members**

Emad S. Salem, Al-Azhar University, Cairo, Egypt

### **Spherically-Hinged Cold-Formed Steel Equal-Leg Angle Columns:**

#### **Experimental Investigation and DSM Design**

Kathleen G. Santana and Alexandre Landesmann, COPPE, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; Dinar Camotim and Pedro B. Dinis, University of Lisbon, Lisbon, Portugal

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## Stability of Structural Systems

**S12** Friday 9:15 a.m. – 10:15 a.m.

Moderator: Benjamin W. Schafer,  
Johns Hopkins University

### **Stability Analysis of Unbraced Steel Storage Racks: Discussions and Alternatives**

Maria A. Branquinho and Maximiliano Malite, University of São Paulo, São Carlos, São Paulo, Brazil; Luiz C. M. Vieira Jr., University of Campinas, São Paulo, Brazil

### **Simulation of Steel Sheathed Cold-Formed Steel Framed Shear Walls and Wall Lines**

Zhidong Zhang and Benjamin W. Schafer, Johns Hopkins University, Baltimore, MD

### **Capturing Cold-Formed Steel Shear Wall Behavior Through Nonlinear Spring Modeling**

Fani Derveni, Simos Gerasimidis, and Kara D. Peterman, University of Massachusetts Amherst, Amherst, MA

### **Stability of Aboveground Open-Top Storage Tanks Subjected to Wind Loading: Static and Dynamic Analyses**

Yen-Chen Chiang and Sukru Guzey, Purdue University, West Lafayette, IN

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## Special Topics in Structural Stability

**S13** Friday 10:45 a.m. – 11:45 a.m.

Moderator: Nicolas Boissonnade,  
Laval University

### **On the Buckling Behavior of Thin-Walled Steel Tubes Subjected to Combinations of Axial Compression and External Lateral Pressure**

Cilmar Basaglia, University of Campinas, Campinas, Brazil; Dinar Camotim and Nuno Silvestre, University of Lisbon, Lisbon, Portugal

### **Investigation on the Effect of Warping on the Behavior of Cold Formed Steel Beam-Columns**

Sevugan Rajkannu and Arul Jayachandran, Indian Institute of Technology Madras, Chennai, India

### **Strengthening Beam Sections of Industrial Buildings against Lateral Torsional Buckling**

Sepehr Movaghati, Poe Engineering Inc., Memphis, TN

### **Stability of Stainless Steel Sections under Simple Loading**

Anne-Sophie Gagné, Lucile Gérard, and Nicolas Boissonnade, Laval University, Québec City, Canada

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## 2019 SSRC annual meeting

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**Welcome** Tuesday 1:00 p.m. – 1:10 p.m. | Larry A. Fahnestock, University of Illinois, Urbana, IL

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### Stability of Structural Members

**SS1** Tuesday 1:10 p.m. – 2:30 p.m.

Moderator: Erica Fischer, Oregon State University

#### **The Strength of Rotary-Straightened Steel Columns**

Xiaomeng Ge and Joseph A Yura, The University of Texas at Austin, Austin, TX

#### **Local Buckling of I-Shape Members Bent about Their Weak Axis**

Anjan K. Bhowmick, Concordia University, Montreal, Quebec, Canada;  
Gilbert Y. Grondin, AECOM Canada Ltd, Edmonton, Canada

#### **Flexural-Torsional Deformations of Imperfect Thin-Walled Columns with Continuous Bracing**

Raymond H. Plaut, Virginia Tech, Blacksburg, VA; Cristopher D. Moen, NBM Technologies, Inc., Baltimore, MD

#### **Topology Optimization of Top Lateral Bracing for Steel Tub Girder Systems Using Genetic Algorithm**

Liwei Han, CHI Consulting Engineers, Summit, NJ; Yang Wang, the University of Texas at Austin, Austin, TX

#### **Experimental and Numerical Studies on the M-V-N Interaction of Longitudinally Stiffened I-Girders**

André Biscaya and José O. Pedro, University of Lisbon, Lisbon, Portugal;  
Ulrike Kuhlmann, Universität Stuttgart, Institut für Konstruktion und Entwurf, Stuttgart, Germany

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### Yoon Duk Kim Memorial Session

**SS2** Tuesday 3:00 p.m. – 4:20 p.m.

Moderator: Larry A. Fahnestock, University of Illinois at Urbana-Champaign

#### **Global Lateral – Torsional Buckling of Steel I-Girder Bridges**

T. Andres Sanchez, Andres F. Robalino, and Santiago P. Zaruma, ADSTREN, Quito, Ecuador

#### **Streamlined Design of Nonprismatic I-Section Members**

Ryan Slein and Donald W. White, Georgia Institute of Technology, Atlanta, GA

#### **Application of Inelastic Buckling Analysis for Design Assessment of Frames Using Nonprismatic I-section Members**

Oguzhan Togay, Ryan Slein, and Donald W. White, Georgia Institute of Technology, Atlanta, GA

#### **Stability of a Tapered Power Pole under Extreme Loading**

Cliff D. Bishop, Exponent Inc., Atlanta, GA; Morgan Griffith, Brian M. McDonald, and Joel M. Wolf, Exponent Inc., Menlo Park, CA

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### Overview of Task Group Objectives

Tuesday 4:20 p.m. – 4:30 p.m.

Moderator: Todd A. Helwig, University of Texas at Austin

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### Task Group Meetings

*parallel breakout sessions for task groups*

**SS3** Tuesday 4:45 p.m. – 5:30 p.m.

#### **TG02 Members: Stability of Steel Members**

Chair: Craig E. Quadrato, Wiss, Janney, Elstner Associates, Inc., Austin, TX

#### **TG03 Systems: Stability of Steel Systems, Especially Frames**

Chair: Graham Cranston, Simpson Gumpertz & Heger, Inc., Waltham, MA

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### Task Group Meetings

*parallel breakout sessions for task groups*

**SS4** Tuesday 5:45 p.m. – 6:30 p.m.

#### **TG04 Stability of Metal Bridges and Bridge Components**

Chair: T. Andrés Sánchez, ADSTREN, Quito, Ecuador

#### **TG05 Thin-Walled Structures**

Chair: Kara Peterman, University of Massachusetts Amherst, Amherst, MA

#### **TG06 Extreme Loads: Stability under Extreme Loads**

Chair: Mina Seif, National Institute of Standards and Technology, Gaithersburg, MD

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## 2019 SSRC annual meeting

### SSRC Annual Business Meeting

**SS5** Tuesday 6:30 p.m. – 7:00 p.m.

- SSRC Business Meeting
- Presentation of the 2018 Vinnakota Award
- Presentation of the 2017 MAJR Medal
- Presentation of the 2018 Beedle Award

### SSRC Social Hour

**SS6** Tuesday 7:00 p.m. – 8:00 p.m.

### McGuire Award for Junior Researchers (MAJR Medal)

The award has been established in honor of the late William “Bill” McGuire to recognize promising young researchers in structural stability. Bill was a long-term member of SSRC who always emphasized that state-of-the-art research is instrumental to improve the quality of stability design. Having served on the faculty at Cornell University for over fifty years, he was the author of the well-known textbooks *Steel Structures* and *Matrix Structural Analysis*. In recognition of his many research and educational contributions to the structural engineering profession, Bill was elected to the US National Academy of Engineering. Recipients of the MAJR Medal must meet the following criteria:

- Member of SSRC.
- Holder of a PhD degree in a stability related topic obtained within the past ten years.
- Have presented at least one paper at an SSRC Annual Stability Conference after obtaining his/her PhD degree.
- Have not previously received the MAJR Medal.

The award committee is appointed by the SSRC Executive Committee. The award is presented at the SSRC Annual Stability Conference. It consists of a bronze medal with the SSRC logo and the lettering “MAJR Medal” engraved on the front side – the back side will show the year of the award and the name of the awardee. The award committee may decide to also recognize an “Honorable Mention,” which will consist of a certificate signed by the SSRC Chair.

### Beedle Award

The award has been established in honor of the late Lynn S. Beedle, an international authority on stability and the development of code criteria for steel and composite structures. He was a leader and outstanding contributor to the work of the Structural Stability Research Council for a period of more than 50 years, establishing the council as the preeminent organization worldwide in the area of structural stability. Through Lynn Beedle’s dedicated work and leadership in the national and international arenas, the structural engineering profession has seen advanced concepts developed into practical engineering tools. He consistently and successfully endeavored to advance collaboration between researchers, engineers and code writers worldwide. Recipients of the Lynn S. Beedle Award must meet the following criteria:

- Longtime member of SSRC.
- A worldwide leading stability researcher or designer of structures with significant stability issues.
- A leader in fostering cooperation between professionals worldwide.
- Significant contributions to national and international design code development.

The SSRC Executive Committee serves as the award committee. The award may be presented as frequently as annually. An individual can only receive the award once. The award is presented at the SSRC Annual Stability Conference. It consists of a framed certificate, signed by the SSRC Chair and Vice Chair.

**Dr. Mina Seif** is a licensed Professional Engineer working as research structural engineer in the National Fire Research Laboratory (NFRL) at the National Institute of Standards and Technology (NIST). Seif’s primary research interests relate to the assessment of structural performance under extreme loads, particularly under fire-induced heating. Prior to joining NIST, Seif received a MSc followed by a PhD in Structural Engineering from the Johns Hopkins University, where his research focused on the cross-sectional stability of high strength structural steel. Seif has also earned a MSc degree in Structural Engineering from Cairo University where his thesis focused on seismic assessment of reinforced concrete buildings. In addition to his research work, Seif has held multiple adjunct professor positions as well as design/consulting positions over the years.

award details from session S4

**W. Samuel Easterling** is the Montague-Betts Professor of Structural Steel Design and Department Head in the Via Department of Civil and Environmental Engineering at Virginia Tech. Easterling received his BSCE and MSCE from West Virginia University and his PhD in Structural Engineering from Iowa State University. He is a registered professional engineer in Virginia. Easterling has taught courses in structural steel design and cold-formed steel design. He has directed research and consulted on projects dealing with a variety of steel-concrete composite and cold-formed steel structures, including composite and non-composite diaphragms. He has been active professionally within AISC, AISI, ASCE and SSRC. His leadership roles have included serving as Chair of the SSRC from 2006-2009.