

**GRADUATE STUDIES**

**STRUCTURAL AND GEOTECHNICAL ENGINEERING  
AND MECHANICS PROGRAM**

**UNIVERSITY OF WASHINGTON**

**DEPARTMENT OF CIVIL ENGINEERING**

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# GRADUATE STUDIES

Structural and Geotechnical Engineering and Mechanics Program

Department of Civil Engineering

University of Washington

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# 1. INTRODUCTION

The Structural and Geotechnical Engineering and Mechanics (SGEM) graduate program is designed to satisfy both the need for advanced specialized knowledge for those students planning to enter (or return) to the profession, and at the same time, to provide PhD students with the tools necessary to perform doctoral research.

The twelve SGEM faculty members teach and perform research in a broad range of areas. The structural engineering faculty are actively working in the areas of:

- active and passive control systems
- computational mechanics
- computer-aided design
- earthquake engineering
- nondestructive evaluation
- risk and reliability
- steel and composite structures,
- structural design and analysis of reinforced concrete
- wind engineering

The geotechnical engineering faculty are actively working in the areas of:

- analysis and design of foundations and retaining structures
- computational geomechanics
- constitutive modeling
- engineering geology
- geosynthetics engineering
- geotechnical earthquake engineering
- insitu testing
- landslide analysis
- soil improvement
- underground engineering

# 2. SGEM DEGREE REQUIREMENTS

The departmental requirements for the Master's and Doctoral degrees are provided in the department brochure. To obtain a Master's degree with thesis, students must complete at least 30 credits of coursework and 9 credits of thesis. To obtain a nonthesis degree, students must complete at least 45 credits: 39 - 42 credits of coursework and 3-6 credits of independent study. The PhD requirements include additional coursework, and successful completion of a Qualifying Examination, General Examination, and Final Examination.

All students specializing in Structural Engineering and Mechanics are required to take Structural Mechanics I and II (CESM 501 and 502), the graduate seminar (CESM 520), plus a minimum of four other graduate (500-level) SGEM classes, unless specifically exempted by their advisor. Students specializing in Geotechnical Engineering are generally expected to take CESM 561 through 566, and PhD aspirants should also take CESM 501.

Students should develop individual programs of study that incorporate suitable courses both from within their major emphasis area and from those offered by other units of the University. Undergraduate courses numbered 400 and above may be counted towards the degree only with the advisor's written agreement, and of the SGEM offerings, only CIVE 437 and CIVE 453 are acceptable. PhD students must maintain a GPA of at least 3.4 in courses appropriate to their program of study.

### **3. SGEM GRADUATE COURSES**

The following courses are offered by the SGEM Program.

**CIVE 437 ENGINEERING GEOLOGY I (3)**

**Taylor**

General overview of engineering geology and its importance to civil engineers. Topics include geologic processes, hazards, origin and classification of geologic materials, data synthesis, and natural construction materials. Prerequisite: GEOL 205 or equivalent.

**CIVE 453 PRESTRESSED CONCRETE DESIGN (3)**

**Eberhard, Stanton**

Analysis, design and construction of prestressed concrete structures. Prerequisite: CIVE 452 or equivalent.

**CESM 501 STRUCTURAL MECHANICS I - STATICS (6)**

**Elias, Miller, Turkiyyah**

Equations of a continuum for small displacements, applications to linear elasticity. Kirchoff Plate theory, problems in advanced strength of materials. Virtual work, minimum potential energy, force and displacement methods of structural analysis. Direct stiffness method. Approximate solutions, geometric stiffness matrix. Linearized buckling.

**CESM 502 STRUCTURAL MECHANICS II - DYNAMICS (3)**

**Eberhard, MacRae, Reed**

Free vibrations of linear, single and multiple-degree-of-freedom systems. Damping. Mode superposition. Forced vibrations by response history and by response spectrum methods. Free and forced vibrations of continuous systems. Wave propagation in rods and beams. Lagrange's equations. Prerequisite: CESM 501 or permission of instructor.

**CESM 503 MATERIALS (3)**

**Arduino, Miller, Reed**

Behavior of materials used in civil engineering structures. Yield and failure surfaces. Physical and phenomenological models of plastic and viscoelastic behavior. Fracture mechanics. Fatigue models and predictions. Damping and friction. Behavior of anisotropic and composite materials.

**CESM 504 FINITE ELEMENT METHODS IN STRUCTURAL MECHANICS (3)**

**Elias, Miller, Turkiyyah**

Extension of the matrix methods of structural analysis to the solution of elasticity, plate and shell problems by use of finite element approximations. Discussion of convergence and bounding, and extension to investigation of stability and finite deformations. Prerequisite: CESM 501 or permission of instructor.

- CESM 505      STRUCTURAL MECHANICS III - NONLINEAR ANALYSIS (3)**  
**Elias, Miller, Turkiyyah**  
Formulation and numerical solution of nonlinear problems in mechanics. Topics include a selection of the following: stability, elasto-plastic analysis, cyclic loading and hysteretic behavior, large displacement theories. Numerical optimization methods and their applications in analysis, design and system identification. Examples from both discrete and continuous systems. Prerequisites: CESM 501, 502, 504, 506.
- CESM 506      COMPUTER AIDED ENGINEERING I (3)**  
**Miller, Turkiyyah**  
Introduction to Programming and Program development: programming abstractions, object-oriented programming, fundamental data structures and algorithms, window-based user interface development, scientific visualization.
- CESM 507      COMPUTER AIDED ENGINEERING II (3)**  
**Miller, Reed, Turkiyyah**  
Knowledge Based Expert Systems: development, problem solving methods, and knowledge acquisition techniques. Database Systems: design and organization, relational and object-oriented databases. Prerequisite: CESM 506.
- CESM 511      ADVANCED REINFORCED CONCRETE DESIGN (3)**  
**Eberhard, Stanton, MacRae**  
Behavior and design of reinforced concrete members and structures. Topics such as members subject to torsion and torsion combined with flexure and shear; members with small shear span/depth ratios, slabs, etc. Prerequisite: CIVE 452 or equivalent.
- CESM 512      ADVANCED PRESTRESSED CONCRETE DESIGN (3)**  
**Eberhard, Stanton**  
Design of statically indeterminate prestressed concrete structures; continuous beam, frame and slab structures, (cast-in-place or assembled from precast units). Prerequisite: CIVE 453 or equivalent.
- CESM 513      ADVANCED STEEL DESIGN (3)**  
**Roeder, MacRae**  
Broad view of factors influencing strength and serviceability of steel structures with emphasis on LRFD limit state design procedures. The use of the theories of plasticity and stability in the development of design methods and specifications, bolted and welded connections, temperature effects, and effect of different fabrication methods on the behavior of the structure. Prerequisites: CESM 501, CESM 503.
- CESM 514      DESIGN FOR EARTHQUAKES (3)**  
**Eberhard, MacRae, Roeder, Stanton**  
Ground shaking and the earthquake mechanisms. Factors affecting severity and frequency of shaking. Concept of ductility and the multi-level design approach. Use of response spectra and design codes such as UBC and ATC, and evaluation of the rationale for these specifications. Prerequisites: CESM 501, 502.

- CESM 516 DESIGN FOR WIND (3)**  
**Reed**  
 Study of wind effects on structures, including: atmospheric boundary layer flow, bluff body aerodynamics, structural dynamics and aeroelasticity; development and use of ASCE-7 standards; estimation of along-wind, across wind and torsional response of tall buildings; design strategies for avoiding wind-induced discomfort in humans. Fundamentals of wind tunnel testing. Prerequisites: CESM 501, 502.
- CESM 520 GRADUATE SEMINAR (1)**  
**Coordinated by SGEM Faculty**  
 A series of weekly seminars presented by the faculty, guest speakers and students.
- CESM 521 Continuum Mechanics - I (3)**  
**Elias, Miller**  
 General formulation of the fundamental concepts of motion, stress and energy for a continuum. General equations of balance of mass, momentum and energy. Linear and nonlinear elastic, viscous and inelastic materials. Offered jointly with AA 575. Prerequisite: CESM 501.
- CESM 523 RELIABILITY AND DESIGN (3)**  
**Reed**  
 Introduction to theory of structural reliability and its application to design procedures in civil engineering, including: probability theory, assessment of uncertainties; code specification (1st order 2nd moment format) and the related concept of risk and the influence of socioeconomic factors; loads, combinations and probabilities of damage.
- CESM 524 RANDOM VIBRATIONS OF STRUCTURES (3)**  
**Reed**  
 Introduction to study of random vibration theory with emphasis upon estimation and analysis of dynamic response of civil engineering structures, including: probability theory; study and analysis of stationary random processes in time and frequency domains; statistics of narrow band processes; modeling of stationary and non-stationary signals, such as wind velocity and earthquake acceleration data. Prerequisites: CESM 501, 502.
- CESM 531 SPECIAL STRUCTURES (3)**  
**SGEM Faculty**  
 A course in special topics such as shells, inflated structures, suspended structures or other specialized forms of civil engineering structures. This course may be repeated by students for credit provided the topics differ. Prerequisite: Permission of instructor.
- CESM 561 SEEPAGE AND CONSOLIDATION (3)**  
**Arduino, Holtz, Kramer**  
 Confined and unconfined flow, flow net solutions, consolidation, settlement, numerical solution of seepage and consolidation problems.
- CESM 562 SHEAR STRENGTH AND SLOPE STABILITY (3)**  
**Arduino, Holtz, Kramer**  
 Stresses and strains in soils, stress paths, stability of shear strength of cohesive and cohesionless soils, creep, slope stability evaluation, numerical analysis of natural and constructed slopes.

- CESM 563      ADVANCED FOUNDATION ENGINEERING (3)**  
**Arduino, Holtz, Kramer**  
 Soil and site investigation; bearing capacity, settlement, and construction considerations of shallow foundations and deep foundations.
- CESM 564      LATERAL EARTH PRESSURE AND RETAINING STRUCTURES (3)**  
**Holtz, Kramer**  
 Earth pressure theories and conventional earth retaining walls; tieback anchored walls and soil nailing.
- CESM 565      SOIL DYNAMICS (3)**  
**Kramer**  
 Dynamics of linear and nonlinear discrete systems, wave propagation, dynamic soil properties, seismic ground response analysis, foundation vibrations, vibration isolation, soil-structure interaction.
- CESM 566      GEOTECHNICAL EARTHQUAKE ENGINEERING (3)**  
**Kramer**  
 Seismology and strong ground motion, deterministic and probabilistic seismic hazard analysis, design ground motions, seismic slope stability, liquefaction, seismic design of retaining structures.
- CESM 567      ADVANCED GEOTECHNICAL LABORATORY (4)**  
**Holtz, Kramer, Taylor**  
 Soil and site investigation, classification and engineering properties of soils and rock as determined by standard and advanced test procedures and equipment. Evaluation of test data. Report writing. Prerequisite: CIVE 366 or equivalent.
- CESM 568      GEOSYNTHETIC ENGINEERING (3)**  
**Holtz**  
 Identification and testing of geosynthetics. Design of geosynthetic filters, roadway stabilization, earth reinforcement and waste containment systems. Prerequisite: 562 and 563.
- CESM 569      FOUNDATION SOIL IMPROVEMENT (3)**  
**Holtz**  
 Analysis and design of physical and chemical treatment techniques commonly applied to problem foundation soils for civil engineering structures. Prerequisite: 563.
- CESM 570      ENGINEERING GEOLOGY II (3)**  
**Taylor**  
 Application of engineering geology fundamentals to location, design and maintenance of engineered structures, policy decisions related to potential geological hazards. Case histories, governmental policy discussions, interpretation of geological maps for engineering purposes. Prerequisite: graduate standing and CIVE 437 or permission of instructor.
- CESM 571      ROCK ENGINEERING (3)**  
**Taylor**  
 Engineering classification, physical and mechanical properties of rocks, failure modes and initial stresses in rocks, laboratory and field testing of rocks, rock slope engineering, underground

openings, foundations on rocks. Prerequisite: graduate standing and CIVE 366 or permission of instructor.

**CESM --- THEORETICAL SOIL MECHANICS (3)**

**Arduino**

Introduction to elastostatics, classical elastostatics, classical elastostatic problems in geomechanics, general theory of consolidation, introduction to boundary element technique and application to geomechanics.

**CESM --- CONSTITUTIVE MODELING OF SOILS (3)**

**Arduino**

Linear and nonlinear elasticity, hypoelasticity, plasticity, yield surfaces, flow rules, hardening functions, implementation in numerical models.

**CESM 599A SPECIAL TOPICS: STRUCTURAL AND GEOTECHNICAL ENGINEERING AND MECHANICS (2-5, max. 15)**

**SGEM Faculty**

Prerequisite: Permission of instructor.

**CESM 600 INDEPENDENT STUDY**

**CIVE 700 MASTER'S THESIS**

**CIVE 800 DOCTORAL DISSERTATION**

## **4. RELATED DEPARTMENTS**

Some of the other disciplines offering courses of potential interest to SGEM graduate students are:

Aeronautics and Astronautics  
Atmospheric Sciences  
Chemical Engineering  
Civil Engineering (CETS and CEWA)  
Computer Science  
Electrical Engineering  
Engineering (College Courses)  
Forest Resources  
Geological Sciences  
Geophysics  
Materials Science and Engineering  
Mathematics and Applied Mathematics  
Mechanical Engineering  
Scientific and Technical Communication

## 5. SGEM FACULTY

### **PEDRO ARDUINO, Assistant Professor**

543-6777, parduino@u.washington.edu

**RESEARCH INTERESTS:** Constitutive modeling of soils, mechanics of porous media, numerical methods in geomechanics.

Macari, E.J., Arduino, P., and Wehie, S. (1997) "Implicit Integration of Multi-Surface Elasto-Plastic Constitutive Models for Frictional Materials," *International Journal of Mechanics of Cohesive-Frictional Materials*, Accepted for Publication.

Arduino, P., Op den Bosch, A., and Macari, E.J. (1997) "Geotechnical Triaxial Soil Testing Within a Virtual Environment," *ASCE Journal of Computing*, Vol. 11, No. 1, pp. 44-47.

Arduino, P., Macari, E.J. (1996) "Multiphase Flow in Deforming Porous Media by the Finite Element Methods," *Proceedings of the 11th ASCE Engineering Mechanics Conference*, Fort Lauderdale, FL.

Macari, E.J., and Arduino, P. (1995) "Overview of 'State of Practice,' Modeling of Overconsolidated Soils," *TRB Record No. 1479 - Engineering Properties and Practice in Overconsolidated Clays*, pp. 51-60.

Arduino, P., Macari, E.J., and Gemperline, M. (1994) "Load-Settlement Prediction of Footings on Steep Slopes," *Proceedings of the ASCE "Settlements 94" Conference*, Texas A & M University, Texas, pp. 1385-1399.

### **MARC O. EBERHARD - Associate Professor, Graduate Program Advisor**

543-4815, eberhard@u.washington.edu

**RESEARCH INTERESTS:** Structural analysis and design, reinforced concrete, earthquake engineering, nondestructive testing of civil structures.

Eberhard, M.O. and Marsh, M.L. (1997), "Transverse-Load Response of a Reinforced Concrete Bridge," *ASCE Journal of Structural Engineering*, April, Vol. 123, No. 4, pp. 451-460.

Eberhard, M.O. and Marsh, M.L. (1997), "Transverse-Load Response of Two Reinforced Concrete Bents," *ASCE Journal of Structural Engineering*, April, Vol. 123, No. 4, pp. 461-469.

Trochalakis, P., Eberhard, M.O. and Stanton, J.F. (1997), "Design of Seismic Restrainers for in-Span Hinges," *ASCE Journal of Structural Engineering*, April, Vol. 123, No. 4, pp. 469-478.

Newtson, C. and Eberhard, M.O. (1995), "Two-Dimensional Magnetic Algorithm to Detect Reinforcing Steel," *ASCE Journal of Materials in Civil Engineering*, August, Vol. 7, No. 3, pp. 1-7.

Pla, G. and Eberhard, M.O. (1995), "Imaging of Reinforced Concrete: State-of-the-Art Review," *Journal of Infrastructure Systems*, ASCE, June, Vol. 1, No. 2, pp. 134-141.

Eberhard, M.O. and Sozen, M.A. (1993), "A Behavior-Based Method to Determine Design Shear in Earthquake-Resistant Walls," *ASCE Journal of Structural Engineering*, February, pp. 619-640.

**ZIAD M. ELIAS - Professor**

543-6129, zelias@u.washington.edu

**RESEARCH INTERESTS:** Theory of matrix structural analysis, finite element methods, geometric non-linearity in space frames, plates and shells.

Elias, Z.M. (1986), *Theory and Methods of Structural Analysis*, John Wiley & Sons.

Elias, Z.M., and Chen, K.L. (1988), "Nonlinear Shallow Curved Beam Element," *J. Eng. Mech.*, ASCE, June.

Elias, Z.M. (1987), "Stiffness Matrix for Geometrically Nonlinear Analysis," Discussion, *J. St. Div.*, ASCE, July.

Elias, Z.M. (1985), "Buckling with Enforced Axis of Twist," *J. Eng. Mech.*, ASCE, Dec.

Elias, Z.M. (1983), "Lateral Stiffness of Flat Plate Structures," *ACI Journal*, Proc. Vol. 80, Jan.-Feb.

Elias, Z.M. (1979), "The Cosserats' Deformable Surface and Shell Theory," *Int. Assn. Shell Spat. Str.*, Bulletin No. 68.

**ROBERT D. HOLTZ - Professor**

543-7614, holtz@u.washington.edu

**RESEARCH INTERESTS:** Geosynthetics, soil improvement, laboratory and in situ testing and instrumentation, environmental geotechnics, foundation engineering.

Holtz, R.D., Christopher, B.R., and Berg, R.R. (1997), *Geosynthetic Engineering*, B.Tech Publishers, Vancouver, B.C., 452 pp.

Holtz, R.D. and Kovacs, W.D. (1981) *An Introduction to Geotechnical Engineering*, Prentice-Hall, Inc., Englewood Cliffs, N.J., 733 pp.

Tsai, W.-S., and Holtz, R.D. (1997), "Laboratory Model Tests to Evaluate Geotextile Separators In-Service," *Proceedings Geosynthetics '97 Conference*, Long Beach, Vol. 2, pp. 633-646.

Juang, C.H., Huang, X.H., Holtz, R.D., and Chen, J.W. (1996), "An Improved Model for Determining Relative Density of Sands from CPT," *Journal of Geotechnical Engineering*, ASCE, Vol. 122, No. 1, pp. 1-6.

Fischer, G.R., Holtz, R.D., and Christopher, B.R. (1996), "Evaluating Geotextile Pore Structure," *Recent Developments in Geotextile Filters and Prefabricated Drainage Geocomposites*, ASTM STP 1281, Shobha K. Bhatia and L. David Suite, editors, American Society for Testing and Materials, pp. 3-18.

Boyle, S.R., Holtz, R.D., and Gallagher, M. (1996), "Influence of Strain Rate, Specimen Length, and Confinement on Measured Geotextile Properties," *Geosynthetics International*, Vol. 3., No. 2, pp. 205-225.

**STEVEN L. KRAMER - Professor**

685-2642, kramer@u.washington.edu

**RESEARCH INTERESTS:** Geotechnical earthquake engineering, foundations, slope stability, system identification.

Kramer, S.L., and Smith, M.W. (1997). "Modified Newmark Model for Seismic Displacements of Compliant Slopes," *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, Vol. 123, No. 7, pp. 635-644.

Kramer, S.L. (1996). *Geotechnical Earthquake Engineering*, Prentice Hall, Upper Saddle River, New Jersey, 653 pp.

Crouse, C.B., Kramer, Steven L., Mitchell, R., and Hushmand, B. (1993), "Dynamic Tests of a Pipe Pile in Saturated Peat," *Journal of Geotechnical Engineering*, ASCE, Vol. 119, No. 10.

Kramer, Steven L. and Robertson, P.K. (1993), "Case Histories in Geotechnical Earthquake Engineering," *Proceedings*, 3rd International Conference on Case Histories in Geotechnical Engineering, Vol. 3, St. Louis, Missouri.

Kramer, Steven L., Von Laun, F.-Y., and Sivaneswaran, N. (1992), "Strain-Controlled, Variable Frequency Cyclic Loading System for Soft Soils," *Geotechnical Testing Journal*, ASTM, Vol. 15, No. 3, pp. 264-270.

Sivaneswaran, N., Kramer, Steven L., and Mahoney, J.P. (1992), "Advanced Backcalculation Using a Nonlinear Least Squares Optimization Technique," *Transportation Research Record 1293*, Transportation Research Board, Washington, D.C., pp. 93-102.

### **GREGORY A. MACRAE - Assistant Professor**

685-8609, macrae@u.washington.edu

**RESEARCH INTERESTS:** Earthquake engineering, design philosophy, steel structures, reinforced concrete, dynamic response, assessment and retrofit of existing structures.

MacRae, G.A. and Kawashima, K. (1997), "Post-Earthquake Residual Displacements of Bilinear Oscillators," *Earthquake Engineering and Structural Dynamics*, Volume 26, pp. 701-716.

Priestley, M.J.N., and MacRae, G. A. (1996), "Testing of Two Precast Post-Tensioned Beam/Column Joint Subassemblages with Unbonded Tendons," *PCI Journal*, January/February, pp. 64-81.

Kawashima, K., and MacRae, G. A. (1994), "Proposal and Application of Residual Displacement Response Spectra," *Journal of the Japan Society of Civil Engineers*, No. 501/I-29, October, pp. 183-192.

MacRae, G. A. (1994), "P-Delta Effects on Single-Degree-of-Freedom Structures in Earthquakes," *Earthquake Spectra*, Vol. 10, No. 3, August, pp. 539-568.

MacRae, G.A., and Kawashima, K. (1992), "Estimation of the Deformation Capacity of Steel Bridge Piers," *Stability and Ductility of Steel Structures under Cyclic Loading*, Edited by Fukumoto, Y. and Lee, G., CRC Press, Inc., pp. 335-347.

### **GREGORY R. MILLER - Professor**

543-3050, gmiller@u.washington.edu

**RESEARCH INTERESTS:** Structural Mechanics: Emphasis on computer-aided engineering, non-linear systems, fracture mechanics, materials, and analytical techniques.

M.D. Rucki and G.R. Miller (1996) "An Algorithmic Framework for Flexible Finite Element-Based Structural Modeling", *Computer Methods in Applied Mechanics and Engineering*, 36(3-4), 363-384.

G.R. Miller and S.C. Cooper (1995) "Something Old, Something New: A Multifaceted Approach to the Teaching of Engineering Mechanics," *ASEE Journal of Engineering Education*, 84(2), 105-115.

G.R. Miller, S. Banerjee and K. Sribalaskandarajah (1995) "A Framework for Interactive Computational Analysis in Geomechanics," *Computers and Geotechnics*, 17(1), 17-37.

G.R. Miller (1993) "Coordinate-Free Isoparametric Elements," *Computers and Structures*, 49(6), 1027-1035.

G.R. Miller (1991) "An Object-Oriented Approach to Structural Analysis and Design", *Computers and Structures*, 40, 75-82.

D.J. Mukai, R. Ballarini, and G.R. Miller (1990), "Analysis of Branched Interface Cracks," *ASME Journal of Applied Mechanics*, 57, 887-893.

**DOROTHY A. REED - Professor**

543-0351; reed@u.washington.edu

**RESEARCH INTERESTS:** Structural control; wind and structural engineering; engineering education.

Reed, D.A., J. Yu, H. Yeh and S. Gardarsson (1997), "Experimental and Theoretical Investigations of Tuned Liquid Dampers," to appear in *Journal of Engineering Mechanics*.

Yu, Jinkyu and D.A. Reed (1997), "An Empirically-Based Nonlinear Mechanical Model of the Tuned Liquid Damper," *Proc. of the 2nd European and African Conference on Wind Engineering*, Genova, Italy, June 22-26.

Yeh, H., D.A. Reed, J. Yu and S. Gardarsson (1996), "Performance of Tuned Liquid Dampers for Large Amplitude Excitation," *Proc. of the 2nd International Workshop on Structural Control*, Hong Kong, Dec.

Kalonji, G. and D.A. Reed (1996), "Challenges to Sustaining Engineering Educational Reform: Engineering "Core" Courses at the University of Washington," *Proc. of the IV Interamerican Conference on Engineering and Technology Education: INTERTECH '96*, Valencia, Venezuela, 22-25 Sept.

Turkiyyah, G.M., D.A. Reed and J. Yang (1995), "Fast Vortex Methods for Predicting Wind-Induced Pressures on Buildings," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol. 58, pp. 51-79.

Jones, N.P., D.A. Reed, and J.E. Cermak (1995), "A National Wind Hazards Reduction Program," *Journal of Professional Issues in Engineering Education and Practice*, ASCE, Vol. 121, No. 1, Jan., pp. 41-45.

**CHARLES W. ROEDER - Professor, (on leave Autumn 1998 - Spring 1999)**

543-6199, croeder@u.washington.edu

**RESEARCH INTERESTS:** The behavior of structures. The design and analysis of steel structures subject to dynamic loadings. Inelastic behavior of steel and composite systems, and thermal effects on structures and components. Structural behavior during earthquakes. Behavior of elastomeric and other structural bearings.

Roeder, C. W. (1997), "Overview of Hybrid and Composite Systems for Seismic Design in the United States," Elsevier, *Engineering Structures*, July, London.

Roeder, C.W., Knechtel, B., Thomas, E., VanPaton, A., Leon, R.T. and Preece, F.R. (1996), "Seismic Behavior of Older Steel Structures," ASCE, *Journal of Structural Engineering*, Vol. 122, No. 4, April.

Roeder, C.W., and Foutch, D.A. (1996), "Experimental Results for Seismic Resistant Steel Moment Frame Connections," ASCE, *Journal of Structural Engineering*, Vol. 122, No. 6, June.

Roeder, C.W., Schneider, S.P., and Carpenter, J.E. (1993), "Seismic Behavior of Moment-Resisting Steel Frames: Analytical Study" and "Experimental Study," ASCE, *Journal of Structural Engineering*, Vol. 119, No. 6, June.

Moorty, S., and Roeder, C.W. (1992), "Temperature-Dependent Bridge Movements," ASCE, *Journal of Structural Engineering*, Vol. 118, No. 4, Apr.

Roeder, C.W., and Stanton, J.F. (1990), "Fatigue of Steel-Reinforced Elastomeric Bearings," *Journal of Structural Division*, ASCE, Vol. 116, No. 2, Feb.

**JOHN F. STANTON - Professor, Program Director, Structural Research Lab Director**

543-6057, stanton@u.washington.edu

**RESEARCH INTERESTS:** Behavior, analysis and design of structures. Precast and prestressed concrete, earthquake engineering, including seismic isolation.

Stanton, J.F., Stone, W.C. and Cheok, G.S. (1997). "A Hybrid Reinforced Precast Frame for Seismic Regions". *PCI Jo.* 42(4), March-April, 20-33.

Trochalakis, P., Eberhard, M.O. and Stanton, J.F. (1997). "Design of Seismic Restrainers for In-Span Hinges". *ASCE Jo. Str. Eng.*, 123(4) Apr. 469-478.

Roeder, C.W., Stanton, J.F. and Campbell, T.I. (1996). "Rotation of High Load Multi-Rotational Bridge Bearings". *ASCE Jo. Str. Eng.*, 121(4), April.

Stone, W.C., Cheok, G.S., and Stanton, J.F. (1995), "Beam-Column Connections Subjected to Cyclic Loads". *ACI Str. Jo.*, Vol. 92(2), March-April, pp. 229-249.

Stanton, J.F., (1992), "Response of Hollow-Core Slab Floors to Concentrated Loads". *PCI Jo.*, 37(4), Jul-Aug, pp. 98-113.

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**TERESA TAYLOR - Assistant Professor**

685-7198, ttaylor@u.washington.edu

**RESEARCH INTERESTS:** Geological and geotechnical centrifuge modeling, experimental soil mechanics.

Taylor, T., Fragaszy, R. and Ho, C. (1991), "Projectile Penetration in Granular Soils," *Journal of the Geotechnical Engineering Division*, ASCE, Vol. 117, No. 4.

Taylor, T. and Fragaszy, R. (1991), "Correlations Between Full-Scale, 1-g and Centrifuge Model Penetration Tests in Granular Soil," *Centrifuge '91, Proceedings of the International Conference on Geotechnical Centrifuge Modeling*, Hon-Yim Ko (ed.), Boulder, Colorado, pp. 481-486.

Fragaszy, R. and Taylor, T. (1989), "Centrifuge Modeling for Projectile Penetration Studies," *Geotechnical Testing Journal*, ASTM, Vol. 12, No. 4.

Taylor, T. and Fragaszy, R.J. (1989), "Implications of Centrifuge Penetration Tests for Use of Young's Equation," *Proceedings, Fourth International Symposium on the Interaction on Non-Nuclear Munitions with Structures*, Panama City Beach, Florida, Vol. 1, pp. 114-118.

Taylor, T., Meyer, M., and Fragaszy, R. (1988), "Design of a Soil Pluviator for Centrifuge Sample Preparation," *Proceedings*, 24th Symposium of Engineering Geology and Soils Engineering, Coeur d'Alene, Idaho, pp. 191-199.

**GEORGE M. TURKIYYAH - Associate Professor, on leave Winter 1998 - Autumn 1998**

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**RESEARCH INTERESTS:** Computer-Aided Engineering: finite element modeling, parallel implementations of finite element methods, system identification, computer-aided geometric design, artificial intelligence applications in civil engineering.

Davids, William and Turkiyyah, George (1997), "Development of an Embedded Bending Member to Model Dowel Action," *ASCE Journal of Structural Engineering*. Vol. 123, No. 10, Oct.

Storti, Duane, Turkiyyah, George, et al. (1997), "Skeleton Based Modeling Operations on Solids," *Proceedings Fourth ACM Conference on Solid Modeling*, May.

Turkiyyah, George and Fenves, Steven (1996), "Knowledge-Based Assistance for Finite Element Modeling," *IEEE Expert.*, Vol. 11, No. 3, pp. 23-32.

Turkiyyah, George M., Reed, Dorothy A., and Yang, Jiyao (1995), "Fast Vortex Methods for Predicting Wind-induced Pressures on Buildings," *Journal of Wind Engineering*, Vol. 58, No. 1, pp. 51-79.

Vimawala, Munikumar and Turkiyyah, George M. (1995), "Computational Procedures for Topological Shape Design," *Computer Methods in Applied Mechanics and Engineering*, Vol. 125, pp. 257-285.

## **6. STRUCTURAL RESEARCH LABORATORY**

The Structural Research Laboratory contains a 2.4 million pound capacity Baldwin universal hydraulic testing machine, together with two smaller Baldwin testing machines of 300,000 pound and 120,000 pound capacities. A modern MTS Testing system includes 60 GPM pumping capacity, and controllers and actuators for testing structural components of various sizes. The laboratory also includes a strong floor, a reaction wall, and a 16 ft x 8 ft earthquake simulator. A wide range of electronic and mechanical equipment is available for the measurement of load and response in structures in the laboratory and in the field. This equipment includes fully computerized data acquisition and processing systems.

## **7. GEOTECHNICAL ENGINEERING LABORATORY**

The Geotechnical Engineering Laboratory contains standard soil mechanics laboratory testing equipment, including soil classification, permeability, consolidation, direct shear, and triaxial testing devices. Specialized research equipment includes a microcomputer-controlled GDS pressure control system and Bishop-Wesley cell for stress path testing, a recently developed cuboidal shear ("true triaxial") device, 250 mm on a side, with complete

computer control of stresses and deformations, as well as data acquisition and control, CKC cyclic triaxial, a SBEL (Stokoe) resonant column device and a large-scale ring simple shear device. A new earthquake simulator with a 2x2x1.5 m soil bin can be used for testing large-scale models under realistic seismic loading conditions. The geosynthetics laboratory contains equipment for routine tests as well as specialized research on the filtration, separation, reinforcement properties of geosynthetics. The Quaternary Research Center also offers modern laboratory facilities, including a 3 m by 5 m tilt slab in a temperature controlled room (+20° to -50°C) for model studies on frozen soils.

## **8. COMPUTER FACILITIES**

The computing environment at the University of Washington has changed rapidly over the past few years and continues to evolve. The department currently maintains a network of about 30 UNIX workstations (Sparcs and UltraSparcs), some with high end graphics boards to support animation and scientific visualization needs. A network of PCs is also available for general use. A multimedia laboratory with facilities for scanning pictures and slides, digital video capture and editing, and color printing is also available. In addition, the University of Washington Computing and Communications department operates a set of UNIX servers and provides access to supercomputers.

## **9. FINANCIAL AID**

Financial aid for graduate students is available from several sources as described below.

### **Teaching Assistantships**

Teaching Assistantships for College of Engineering courses and for SGEM undergraduate courses are available on a competitive basis. The duties generally consist of conducting laboratory sessions, holding consultation hours for students, and grading, homework and laboratory reports. The nominal time commitment is 20 hours per week, but in practice, the time will vary from week to week. The stipend is currently \$1,088 per month, and the Department pays for all tuition and fees except \$135 per quarter. The ability to communicate well in English is a primary prerequisite for a Teaching Assistantship. Teaching assistants are expected to take the thesis option.

### **Research Assistantships**

The number of Research Assistantships available depends on the number of externally funded research grants and contracts in the Program. Research Assistantships are awarded by the faculty member who is the Principal Investigator on the project. The duties vary among projects, and the financial arrangements are the same as for TA's. Research Assistants at the MS level are expected to take the thesis option.

### **Valle Fellowships**

These fellowships, funded by the Valle Scholarship and Scandinavian Exchange Program, are open to students in Civil Engineering, Architecture, and Urban Planning. Fellowships are available for graduate students to study at the University of Washington, or for U.W. or Scandinavian students to study at the exchange institution under an Exchange Scholarship Agreement.

Several students from SGEM (one half for U.S. students to study at the U.W. and the other half for exchange study) are awarded Valle fellowships each year. Fellowships are granted only to students with outstanding undergraduate academic records.

Valle Fellows are expected to show superior academic performance in both coursework and research. Currently, Valle Fellows receive a stipend of \$1,400 month, plus the operating fee of tuition. Any additional registration fees such as the remaining student fees (currently \$135 per quarter) are paid by the student. MS students are expected to take the thesis option.

### **Geotechnical Engineering Fellowships**

The Shannon Fellowships are awarded to graduate students in geotechnical engineering. This fellowship is funded by a bequest of Mr. and Mrs. W.L. Shannon, and by Shannon and Wilson, Inc. In addition, the new Hong-West scholarship partially supports a geotechnical graduate student.

### **Other Assistantships and Scholarships**

A few assistantships for women and underrepresented minorities are available from the Graduate School and other sources. Those students who qualify for such special assistantships will be recommended by the Graduate Program Advisor, who will redirect the application to the appropriate agency. Some lump-sum scholarships are occasionally available from a variety of sources (College of Engineering, industry, etc.). Most are restricted to U.S. students.