CURRICULUM VITAE

PERSONAL

Name:	ALEJANDRO MOTA
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EDUCATION

CORNELL UNIVERSITY 1994–1999

Ph.D. in Structural Engineering
Dissertation: A Class of Geometrically Exact Membrane and Cable Finite Elements Based on the Hu-Washizu Functional
Advisor: Professor John F. Abel
Grade point average: 3.95/4.0

Description

The spurious stresses and strains phenomenon in geometrically exact C^0 cable and membrane elements due to error in the computed gradient of the primary field is studied. This problem is more severe in geometrically exact finite elements, in view of the large displacements and rotations involved. Thus, the emphasis is on the analytical foundations of the problem, the objective being to devise a method to reduce or eliminate this phenomenon. The proposed approach is based on mixed formulations and its relation to gradient recovery techniques frequently used in finite element analysis. After devising this method for the reduction of spurious stresses and strains in geometrically exact cable and membrane finite elements, numerical studies are carried out to verify its performance. This thesis involves programming in C for UNIX.

NATIONAL AUTONOMOUS UNIVERSITY OF MEXICO 1990–1993

Master of Science in Structural Engineering
Thesis: A Nonlinear Analytical Model for the Seismic Response of Reinforced Concrete Bridges
Advisor: Professor Gustavo Ayala
Grade point average: 9.3/10.0

Description

The applicability of linear methods and the need for material nonlinear analyses for reinforced concrete bridges subjected to strong earthquakes are investigated. The basis of the analytical model for the nonlinear material analysis is a generalized yielding surface based on polynomials of cubic order. The model is applied to the analysis of three existing reinforced concrete bridges of practical interest, and the results, together with those obtained from corresponding linear simulations, are analyzed and discussed. This thesis involves programming in C, C++ and Fortran for UNIX.

AUTONOMOUS UNIVERSITY OF AGUASCALIENTES (Mexico) 1985 – 1990
Bachelor of Science in Civil Engineering. Five year program. Summa cum laude.
Senior thesis: Finite Difference Model for Analysis of Pile Foundations. Required C programming.
Grade point average: 9.6/10.0

AWARDS

Autonomous University of Aguascalientes 1990
Summa cum laude in Civil Engineering

Autonomous University of Aguascalientes 2004
Highest GPA in 30 years

National Council for Science and Technology (CONACYT, Mexico) 1994–1998
Fellowship for Doctorate Studies

PROFESSIONAL EXPERIENCE

Staff Scientist (full-time) August 2003–present

California Institute of Technology

Studied, developed and implemented methods and algorithms for the computer simulation by the finite element method of fracture and fragmentation of brittle and ductile materials subjected to impact by high speed loads; in particular, ceramics and metals. Studied, developed and implemented constitutive models for the finite element simulation of strain localization, fracture and fragmentation of ductile metals (porous plasticity) subjected to high velocity loads. Studied, developed and implemented methods for the finite element simulation of fracture and fragmentation of kidney stones treated with lithotripsy (ultrasound) and traumatic damage to the human brain. Studied, developed and implemented methods for the finite element simulation of fracture and fragmentation of polymers such as polyurea for its use in steel-polyurea composites.

Postdoctoral Scholar (full-time) October 1999–August 2003

California Institute of Technology

Studied, developed and implemented methods and algorithms for the computer simulation by the finite element method of fracture and fragmentation of brittle materials subjected to impact by high speed penetrators; in particular, wounds to the human skull due to firearms. Studied, developed and implemented constitutive models for the finite element simulation of ballistic penetration, strain localization fracture and fragmentation of metallic glasses (amorphous metals).

Consulting Engineer July 1991–January 1997

TECNIA (Tecnia Engineering Ltd., Aguascalientes, Mexico)

Served intermittently as external consultant for structural analysis and design of reinforced concrete and steel medium rise buildings and industrial warehouses. Developed software for structural analysis and design.

Project Engineer (full-time) July 1993–July 1994

IOIS (Operations Research and Systems Engineering Ltd., Mexico City, Mexico)

Coordinated and conducted structural analysis and design of high rise reinforced concrete and steel office buildings and industrial warehouses. Coordinated and conducted finite element analysis for deep foundations. Developed software for structural analysis and design.

Project Engineer (full-time) September 1990–May 1992

INSISA (Systems Engineering Ltd., Mexico City, Mexico)

Coordinated and conducted structural analysis and design of steel and concrete structures for water supply and sewage systems. Developed software for water supply and sewage systems.

Computer Programmer (part-time) September 1987–September 1990

Institute of Geography, Statistics and Informatics (Office of the Census, Mexico)

Developed, installed and maintained database software for financial and budget management systems.

TEACHING EXPERIENCE

Cornell University. CEE 772. Finite Element Analysis. Graduate-level course. Spring 1998
Teaching Assistant for Prof. John F. Abel.

Cornell University. CEE 673. Advanced Structural Analysis. Graduate-level course. Fall 1998
Teaching Assistant for Prof. John F. Abel.

JOURNAL PUBLICATIONS

A. Mota, J.F. Abel. On Mixed Finite Element Formulations and Stress Recovery Techniques, *International Journal for Numerical Methods in Engineering*, 47 (191-204) 2000.

A. Mota et al. Finite Element Simulation of Firearm Injury to the Human Cranium, *Computational Mechanics*, 31 (115-121) 2003.

A. Mota, J.F. Abel. Stress Recovery in Geometrically Nonlinear Cables and Membranes by a Hu-Washizu Finite Element Formulation, *Computational Mechanics*, 36:3 (171–181), 2005.

K. Weinberg, A. Mota, M. Ortiz. A Variational Constitutive Model for Porous Metal Plasticity, *Computational Mechanics*, 37:2 (142–152), 2006.

Q. Yang, A. Mota, M. Ortiz. A class of variational strain-localization finite elements, *International Journal for Numerical Methods in Engineering*, 62 (1013-1037) 2005.

Q. Yang, A. Mota, M. Ortiz. A Finite-Deformation Constitutive Model for Bulk Metallic Glasses *Computational Mechanics*, 37:2 (194–204), 2006.

A. Mota, J. Knap, M. Ortiz. Three-dimensional fracture and fragmentation of artificial kidney stones, *Journal of Physics: Conference Series*, 46 (299–303), 2006

A. Mota, J. Knap, M. Ortiz. Fracture and Fragmentation of Simplicial Finite Elements Meshes using Graph Theory, *International Journal for Numerical Methods in Engineering*, in print.

T. Elsayed, F. Fraternali, A. Mota, M. Ortiz. Impact Induced Shear and Volumetric Damage of Brain Tissue *Neurosurgery*, in preparation.

T. Elsayed, F. Fraternali, A. Mota, M. Ortiz. A Variational Viscoelastic-Elastoplastic Constitutive Model for Soft Materials *Journal of Mechanics and Physics of Solids*, in preparation.

CONFERENCE PUBLICATIONS

A. Mota. Nonlinear Model for the Seismic Response of Reinforced Concrete Bridges (in Spanish), *Proceedings of the Tenth National Congress of Earthquake Engineering*, Mexico, 1993.

A. Mota, J.F. Abel, Improved Accuracy of Stresses from Hu-Washizu Formulation for Membranes with Mesh Distortion, *Proceedings of the Fourth International Colloquium on Computation of Shell and Spatial Structures*, Crete, Greece, 2000.

A. Mota et al. Finite-element simulation of firearm injury to the human cranium. *Proceedings of the Second Congress on Numerical Methods in Engineering and Applied Sciences*, Barcelona, 2002.

PRESENTATIONS

The Hu-Washizu Finite Element Formulation as a Stress Recovery Method, *Fifth US National Congress on Computational Mechanics*, University of Colorado, Boulder, 1999.

Finite Element Simulation of Firearm Injury to the Human Cranium, *Sixth US National Congress on Computational Mechanics*, Dearborn, Michigan, 2001.

Finite Element Simulation of Ballistic Penetration of the Human Skull, *10th International Conference on Fracture*, Honolulu, Hawaii, 2001.

Finite Element Simulation of Firearm Injury to the Human Cranium, (in Spanish), *Second Congress on Numerical Methods in Engineering and Applied Sciences*, Guanajuato, Mexico, 2002.

Finite Element Simulation of Impact, Shear Band Formation, Fracture and Fragmentation of Thermo-Viscoplastic Solids, *5th World Congress on Computational Mechanics*, Viennna, Austria, 2002.

Finite-deformation Shear Band Elements for Three-dimensional Shear Band Propagation Analysis, *7th US National Congress on Computational Mechanics*, Albuquerque, New Mexico, 2003.

Fracture and Fragmentation of Simplicial Finite Elements Meshes using Graphs, *8th US National Congress on Computational Mechanics*, Austin, Texas, 2005.

Fracture and Fragmentation of Simplicial Finite Elements Meshes using Graphs, *7th World Congress on Computational Mechanics*, Los Angeles, California, 2006.

Dynamic Brittle and Ductile Fracture with Cohesive and Localization Elements, *ASME Applied Mechanics and Materials Conference, 2007*, Austin, Texas, 2007.

SEMINARS

Applied Numerical Computation (in Spanish), *Autonomous University of Aguascalientes, Mexico*, March 5, 2001

Finite Element Simulation of Firearm Injury to the Human Cranium, *University of California, Los Angeles*, March 15, 2001

Finite Element Simulation of Firearm Injury to the Human Cranium, *Rice University*, April 30, 2001

Computational Mechanics of Impact, Fracture and Fragmentation, *Princeton University*, February 14, 2002

Finite-deformation Shear Band Elements for Three-dimensional Shear Band Propagation Analysis, *Cornell University*, April 14, 2003

Finite Element Simulation of Firearm Injury to the Human Cranium, *Cornell University*, April 14, 2003

Finite-deformation Shear Band Elements for Three-dimensional Shear Band Propagation Analysis, *Lawrence Livermore National Laboratory*, May 3, 2003

A Class of Variational Strain-Localization Finite Elements, *University of California, Los Angeles*, February 12, 2004

Fracture and Fragmentation in Finite Element Analysis using Graph Theory, *Cornell University*, October 16, 2004

Computational Mechanics of Impact, Fracture and Fragmentation (in Spanish), *Autonomous University of Aguascalientes, Mexico*, October 29, 2004

Finite-Element Simulation of Strain Localization, *Rensselaer Polytechnic Institute*, March 29, 2005

Finite-Element Simulation of Strain Localization, *University of Minnesota, Twin Cities*, May 3, 2005

Direct Numerical Simulation of Fracture, Fragmentation and Strain Localization, *Oak Ridge National Laboratory*, February 14, 2006

Finite-Element Simulation of Strain Localization, *California Institute of Technology*, August 4, 2006

A variational constitutive finite-deformation model for porous metal plasticity and its application to the simulation of dynamic ductile fracture. *Lawrence Livermore National Laboratory*, December 12, 2006

AFFILIATIONS

Member, Sigma Xi - The Scientific Research Society, 2001

Member, US Association of Computational Mechanics, 2002

Member, International Association of Computational Mechanics, 2002

Member, The Planetary Society, 2000