

Name: **Miguel Cerrolaza Rivas**  
Born: **December 3<sup>rd</sup>, 1957**  
Status: **Married, one (beautiful) daughter**  
Current position: **Visiting Senior Researcher, CIMNE-UPC (Barcelona)**  
Email: **mcerrolaza@cimne.upc.edu**

## **AREAS OF INTEREST AND RESEARCH LINES**

Bioengineering, computational biomechanics, applied mathematics, finite elements, boundary integral methods

## **STUDIES**

M. Cerrolaza is graduated in **civil engineering** from the Central University of Venezuela in 1980 (awarded *Magna Cum Laude*), also awarded by the Venezuelan Society of Engineers as the Best Graduated in Engineering. In Jan-1980 he got a grant from UNESCO (programme B-31) and went to Universidade Federal of Rio de Janeiro (Brazil) to study the **Magister Scientiarum in Engineering**. In Sept-1985, he won a scholarship from the Institute for Iberoamerican Cooperation (ICI-Spain) to undertake **doctoral studies** at the Polytechnic University of Madrid, completed in June-1988 (the Thesis was awarded *Cum Laude* and won the *UPM Best Doctoral Thesis* award). In Jan-1995, he was invited by the Ecole Nationale des Ponts et Chaussees (Paris, France), to pursue a **Postdoctoral stay**. He was granted by a postdoc-fellowship from the Venezuelan Ministry of Science and Technology.

## **ACADEMIC AND SCIENTIFIC POSITIONS**

- Sept2010-present. Visiting Senior Researcher, International Centre for Numerical Methods in Engineering (CIMNE), Polytechnic University of Catalonia (UPC), Spain
- Feb2011-present. Founder and Head of the Department for Advanced Simulation in Biomechanics (DASCB) inside CIMNE-UPC
- Oct2011-present. Founder of the *Iberoamerican Institute of Bioengineering*, Polytechnic University of Catalonia, Spain (in process of creation)
- 1995-1996. Visiting Senior professor at Ecole Nationale des Ponts et Chaussees (Paris)
- 1989-2010. Full Professor, Central University of Venezuela
- 1985-1988. Invited Professor at the School of Industrial Engineers, Polytechnic University of Madrid, Spain
- 1981-1984. Assistant Professor, Faculty of Engineering, Central University of Venezuela
- 1980-1981. Visiting researcher at the Computational Mechanics Laboratory, Federal University of Rio de Janeiro, Brazil

## **OTHER ACADEMIC POSITIONS**

- 2006- Founder and Coordinator of the Postgraduate Program in Bioengineering, Central University of Venezuela
- 2005- Director of the National Bioengineering Institute, Central University of Venezuela
- 2004 and 2006 (2 months each). Visiting professor at Colorado School of Mines (USA)
- 1995-2005. Director of the Bioengineering Centre, Central University of Venezuela
- 1994-1995. President of the Doctoral Commission, Central University of Venezuela
- 1994-1995. President of the National Commission for Engineering, Ministry of Science and Technology, Venezuela
- 1993- President and founder of the Venezuelan Society for Numerical Meth. in Eng.

## GRANTS, AWARDS AND NOMINATIONS

### *Grants and fellowships*

- Visiting research grant (Spanish Ministry of Science and Education), April-2011
- Senior researcher grant (CIMNE-UPC), Sept-2010
- Fellowship of the Venezuelan Scientific National Council (Ministry of Science and Technology) for postdoctoral studies at ENPC, Paris, France, Jan-1995
- Fellowship of the Spanish Institute for Cooperation with Iberoamerica (ICI) for doctoral studies, Madrid, Nov-1985
- Fellowship from UNESCO B-31 for MSc studies, Jan-1980

### *Awards and nominations*

- Selected to be included in the book “*Successful Iberoamerican university researchers*” (24 researchers in Iberoamerica), published by the Santander Foundation, 2010, Spain
- *UCV Best Graduate and Research Projects* award, 2010
- *Biennial “Dr. Francisco Duarte”* award of the Central University of Venezuela to the Best Book and Monograph, 1994, 2006, 2008, 2010
- Selected and nominated by the Venezuelan Academy of Mathematical, Physical and Natural Sciences to the Third World Academies of Sciences (TWAS) Prize in Technology, 2008
- *Best Researcher* award of the Council for Scientific Research, 2008
- “*Dr. Francisco de Venanzi*” award for the Best Researcher of the Central University of Venezuela, 2007
- Selected and nominated by the Central University of Venezuela to the International Mexican Prize in Science and Technology, 2007
- “*Simón Bolívar*” award of the Ministry of Science and Technology (Research Chair), 2006
- *Best Scientific Work* award of the Central University of Venezuela, 1994, 2005, 2006
- “*Dr. Andrés Bello*” award of the Venezuelan Government for the Best National Scientific and Research Trajectory (*First Class*), 2001
- *Best Research Trajectory in Technology* award of the Venezuelan Association of University Professors, 1997, 1998
- Award of the Polytechnic University of Madrid to the *Best Doctoral Thesis in 1988 (Cum Laude degree)* for outstanding doctoral dissertation on “New mathematical algorithms and numerical approaches for integral equation methods adaptivity”.
- Venezuelan Engineers Society award to the *Best Civil Engineer*, 1980
- *Magna Cum Laude* degree in civil engineering, 1980

## MAIN TEACHING ACTIVITIES

- From March-2012. Graduate engineering courses: *Modelling and Analysis in Biomechanics*, MSc Erasmus Mundus European Master in Computational Mechanics (UPC and Swansea University), Polytechnic Univ. of Catalonia, Spain
- 2010-present. Advisor of postgraduate theses at CIMNE, Polytechnic Univ. of Catalonia, Spain
- 1989-2011. Graduate engineering courses: *Theory of elasticity, Biomechanics, Theory of Finite Elements, Finite Elements for Structural engineers, Mathematical methods for Continuous Media*, Central University of Venezuela
- 1983-1985 and 1989-1993. Undergraduate eng. courses, Central University of Venezuela

## SEMINARS, CONFERENCES AND LECTURES AT UNIVERSITIES AND HEIs

### *In Europe*

- Technical University of Dortmund (Germany)
- Ecole Nationale des Ponts et Chaussees (Paris, France, seven times)
- Universidad de Las Palmas de Gran Canaria (Spain, six times)
- Universidad Politécnica de Madrid (Spain, three times)
- Universidad Politécnica de Cataluña (Spain, twice)
- Universidad de Zaragoza (Spain)
- University of Brescia (Italy)
- Technische Universität Braunschweig (Germany)
- Technische Universität Graz (Austria)
- Wessex Institute of Technology (UK)
- University of Jyväskylä (Finland)
- Technical University of Lodz (Poland)
- University of Sevilla (Spain)

#### *In the United States*

- Florida Atlantic University (USA)
- University of Central Florida (USA)
- Colorado School of Mines (USA, twice)
- University of Denver (USA)
- Florida International University (USA, twice)

#### *In Asia*

- National Research Council (New Delhi, India)
- University of Sydney (Australia)
- University of Sapporo (Japan)
- University of Kyoto (Japan)

#### *In Latinamerica*

- Universidad Nacional de Cuyo (Argentina)
- University of Sao Paulo (Brazil)
- Universidad de la República (Uruguay)
- Instituto Superior Politécnico José Antonio Echeverría (Cuba)
- University of Las Villas (Cuba)
- University of Los Andes (Colombia)
- Universidad Argentina de la Empresa (Argentina)
- Pontifical Catholic University of Medellín (Colombia)
- University of Sinaloa (México)
- National University of Trujillo (Perú)
- National University (Bogotá, Colombia)
- University of Guanajuato (México)
- Central University (Bogotá, Colombia)
- University of Entre Rios (Argentina)
- Laboratorio Nacional de Computação Científica (Brazil)
- University of El Valle (Bolivia)

### **SELECTED INVITED LECTURES AND SEMINARS**

Since 1993, he has been invited to deliver around 37 Plenary/Semi Plenary/Keynote Lectures/Seminars in relevant conferences in the field of computational mechanics and mathematical-numerical simulation, among them:

- Cerrolaza M, *Invited Conference*, Centre de Enseignement et Recherche en Mathematiques et Calcul Scientifique, Ecole Nationale des Ponts et Chaussees, Paris, France, July 1993
- Cerrolaza M, *Invited Conference*, University of Dortmund, Germany, Oct 1995
- Cerrolaza M, *Invited Conference*, Centre de Enseignement et Recherche en Mecanique des Sols, Ecole Nationale des Ponts et Chaussees, Paris, France, June 1996
- Cerrolaza M., *II PanAmerican Workshop in Appl. & Comp. Math.*, **Plenary Lecturer**, Sponsored by the Society of Industrial and Applied Math.(SIAM, USA), Granados, Brazil, 1997
- Cerrolaza M., *IV World Cong. on Comp. Mechanics*, **Semi Plenary Lecturer**, Buenos Aires, Argentina, July 1998
- Cerrolaza M., *II Int. Conf. on Biomechanics*, **Plenary Lecturer**, Lodz, Poland, 1998
- Cerrolaza M., *Invited Seminar*, Pole Scientifique of Dassault Aviation. Paris, France, 1999
- Cerrolaza M. and Martínez G., *Third Int. Conference on BeTeQ*, **Plenary lecturer**, Beijing, China, 2002
- Cerrolaza M. and Annicchiarico W., *III EuroGen Cong. on Genetic Algorithms*, **Semi Plenary Lecturer**, Finland, 1999
- Cerrolaza M, *Invited Conference*, Dept of Mechanical and Mechatronic Engineering, College of Science and Tech., Univ. of Sydney, Australia, Nov 2000
- Cerrolaza M. and Sulem J., *Conf. Scientifique Internationale CERMES 21*, **Plenary Lecturer**, Paris, Sept 2001.
- Cerrolaza M and Zeman M, *Fifth Int. Conf. on Simulations in Biomed*, **Keynote Lecturer**, Slovenia, april 2003
- Cerrolaza M. and Martínez M., *Invited Conference*, Industrial Engineers School, Technical Univ. of Madrid, Spain, dec 2003
- Cerrolaza M., *Invited Seminar*, Eng. Division, Colorado School of Mines, USA, Jan 2004
- Cerrolaza M., *Invited Seminar*, School of Eng. & Comp. Sci, Univ of Denver, USA, Feb 2004
- Cerrolaza M., *Invited Conference*, University of Sao Paulo, Brazil, Oct 2005
- Martínez, M. and Cerrolaza M., *VIII Cong. of Comp. Mech.*, **Plenary Lecturer**, Buenos Aires, Nov 2005
- Cerrolaza M., *Invited Conference*, School of Engineers, Univ of Seville, Spain, February 2006
- Cerrolaza M., *Invited Conferences*, Dept. of Mathematics, University of Los Andes, Bogotá, Colombia, May 2006
- Cerrolaza M., *Invited Seminars*, Engineering Div., Colorado School of Mines, USA, June 2006
- Cerrolaza M., *XV Cong Num Meth & Appl.*, **Plenary Lecturer**, Santa Fe, Argentina, Nov 2006
- Cerrolaza M, *Invited Conference*, Applied Research Centre, Florida International University, USA, March 2007
- Cerrolaza M, *Invited Conference*, Int. Centre for Numerical Meth in Eng, Polytechnic University of Catalonia, Barcelona, Spain, March 2007
- Cerrolaza M. and González Y., *XVI Cong on Num Meth and their Appl.*, **Plenary Lecturer**, Córdoba, Argentina, Oct 2007
- Cerrolaza M, *Invited Conference*, Adaptive Materials and Structures Lab, School of Engineering, Kyoto University, Dec 2007
- Cerrolaza M, *APCOM'07 and XI EPMESEC Cong.*, **Invited Speaker**, Kyoto, Japan, Dec 2007
- Cerrolaza M, *Invited Seminar*, University of Braunschweig, Germany, July 2008
- Cerrolaza M., *I Cong. Sci. Comp. Health App*, **Invited Lecturer**, Petrópolis, Brazil, June 2010
- Cerrolaza M., *XXXI Iberian Latinamerican Cong on Comp Meth in Eng*, **Semi-plenary Lecturer**, Buenos Aires, Argentina, Nov 2010

- Cerrolaza M., *AAAS Annual Meeting (American Association for Advance of Science)*, **Invited Speaker**, Washington, USA, Feb 2011
- Cerrolaza M., *Int. Congress of IABEM*, **Plenary Lecturer**, Brescia, Italy, September 2011
- Cerrolaza M., *I Int'l Congress on Biomedical Engineering*, **Invited Lecturer**, Cochabamba, Bolivia, Nov 2011
- Cerrolaza M., *Int. Conf. on Comp. & Exp. Eng. Sci. (ICCES12)*, **Thematic Lecturer**, Crete, Greece, May 2012
- Cerrolaza M., Uzcátegui G., *X World Cong. Comp. Mechanics (WCCM'2012)*, **Keynote Lecturer**, Sao Paulo, Brazil, July 2012
- Cerrolaza M., *XIX Cong on Num Meth and their Appl.*, **Plenary Lecturer**, Salta, Argentina, Nov 2012
- Cerrolaza M., *Invited Seminar*, Biomedical Engineering Institute, Florida Int'l University, USA, Dec 2012
- Cerrolaza M., *Invited Conference*, Faculty of Bioengineering, National University of Entre Rios, Argentina, Feb 2013

### **MEMBERSHIPS TO EDITORIAL/SCIENTIFIC BOARDS OF INT'L JOURNALS**

- J. of Finite Elements in Analysis and Design, USA
- J. of Comp. Mod. in Eng & Sciences, USA
- J. of Biomedical Eng Research, China
- J. of Computers in Biology and Medicine, USA
- J. of Bionic Engineering, USA
- J. of Biomedical Engineering and Technology, USA
- J. of Mathematical Prob. In Eng, USA (2008-2012)
- J. of Mechanics in Medicine & Biology, Singapore
- J. of Biomedical Eng: Applications, Basis and Comm., UK
- Revista Int. de Mét. Num. en Ing., Spain

### **SOCIETIES AND ACADEMIES**

- Associate Member of the Venezuelan Academy of Physical, Natural and Math Sciences
- Member of the International Society of Boundary Elements, UK
- Member of the Spanish Society for Numerical Methods in Eng., Spain
- Member of the European Society of Biomechanics, Europe
- Elected member of the International Association of Computational Mechanics , USA
- Founder member of the Colombian Society of Numerical Methods, Colombia
- Founder and President of the Venezuelan Society for Num. Meth. In Eng, Venezuela
- Venezuelan National Program for Researchers Promotion (SPI), highest level IV

### **PEER REVIEW**

Reviewer for articles in the following journals:

Finite Elem. in Analysis and Design, Comp. Meth. in Appl. Mech. & Eng., Advances in Eng. Software, Electronic J. of Boundary Elements, Bound. Elem in Eng. Analysis, Appl. Math. Modelling, Num. and Analytical Meth. in Geomechanics, Biomedical Eng. and Tech., Numerical Meth. in Eng., Mech. in Med. & Biol., Math. Prob. in Eng., Rev. Int. Met. Num. Anal. Dis. Ing.

### **CONGRESSES ORGANIZATION AND SCIENTIFIC COMMITTEES**

*Congresses organization/coorganization*

- I Int Cong on Comp Bioeng (ICCB2003), Coorganizer, Zaragoza, Spain, Sept 2003
- II Int Cong on Comp Bioeng (ICCB2005), Coorganizer, Lisbon, Portugal, Sept 2005
- III Int Cong on Comp Bioeng (ICCB2007), Main organizer, Margarita, Venezuela, Sept 2007
- IV Int Cong on Comp Bioeng (ICCB2009), Coorganizer, Bertinoro, Italy, Sept 2009
- V Int Cong on Comp Bioeng (ICCB2013), Coorganizer, Belgium, Sept 2013
- Main organizer of 11 Latinamerican Congresses (serie CIMENICS), 1992-2012
- Bioseminar: *Seminar on Bioengineering*, Organizer, CIMNE-UPC, Barcelona, Nov 2010

*Member of the scientific/organizing committees of several congresses, among them:*

- 4<sup>th</sup> World Cong on Comp Mech., Buenos Aires, Argentina, 1998
- I International Conference on Bound. Elem. Tech. (BETEQ'1999), London, 1999
- 5<sup>th</sup> World Cong on Comp Mech., Vienna, Austria, 2002
- V Cong. on Comp. Mech. (MECOM'2002), Santa Fe, Argentina, 2002
- 6<sup>th</sup> World Cong on Comp Mech., Beijing, China, 2004
- IV Latinoamerican Cong on Biomedical Eng., Margarita, Venezuela, 2007
- 5<sup>th</sup> European Cong on Comp Meth in App. Sciences, Venice, Italy, 2008
- 9<sup>th</sup> World Cong on Comp Mech., Sydney, Australia, 2010
- Int. Conf. on Geomechanics (GeoFlorida'2010), West Palm Beach, USA, 2010
- III Int'l Congress on Num Meth in Eng (CIMAT'2010), México, 2010
- XXXI CILAMCE, Buenos Aires, Argentina, Nov 2010
- Int. Conf. Evol. & Det. Meth. for Des. And Control with App. (ECCOMAS-EUROGEN 2011), Italian Aerospace Center, Italy, 2011
- 7<sup>th</sup> Int. Conf. on Inverse Prob. in Eng. (ICIPE 2011), Florida, USA, 2011
- 2<sup>nd</sup> International Symposium of App. in BEM, Brescia, Italy, 2011
- World Congress on Advances in Structural Engineering and Mechanics (Asem11+), Seoul, Korea, Sept 2011
- 10<sup>th</sup> World Cong on Comp Mechanics, Sao Paulo, Brazil, 2012
- X Cong. on Comp. Mech. (MECOM'2012), Salta, Argentina, Nov 2012
- 10th International Conference on Evolutionary and Deterministic Methods for Design, Optimization and Control with Applications to Industrial and Societal Problems (Eurogen'2013)
- 8th International Conference on Inverse Problems in Engineering (ICIPE-2014), Cracow, Poland, May 2014

## **PUBLICATIONS IN INTERNATIONAL JOURNALS**

- 1 Cerrolaza M., Alarcón E., "P-adaptive boundary elements for three dimensional potential problems", *Comm. in Num. Methods in Eng.*, **3**:335-344, 1987
- 2 Gómez B., Cerrolaza M. and Alarcón E., "QL-CONST1: an expert system for quality level prediction in concrete structures", *J. of Civil Eng. and Env. Systems*, **5(4)**:206-212, 1988
- 3 Alvarez R., Molina J. and Cerrolaza M., "Practical seismic analysis using Ritz Basis", *J. of Adv. Eng. Soft. (formerly J. of Soft. for Eng. Workst.)*, **4(2)**:186-192, 1988
- 4 Cerrolaza M., Gómez S. and Alarcón E., "Elastostatics p-adaptive boundary elements for micros", *J. of Adv. Eng. Soft. (formerly J. of Soft. for Eng. Workst.)*, **4(1)**:18-24, 1988
- 5 Beltran F. and Cerrolaza M., "Engineering applications of explicit integration algorithms on microcomputers: dynamic analysis of structures under non-linear loads", *J. of Adv. Eng. Soft. (formerly J. of Soft. for Eng. Workst.)*, **5(4)**:79-90, 1989
- 6 Cerrolaza M. and Alarcón E., A bi-cubic transformation for the numerical evaluation of the

- Cauchy principal value integrals in boundary methods, *Int. J. of Num. Meth. In Engineering*, **28**(5): 987-999, 1989
- 7 Guillén A., Cerrada C. y Cerrolaza M., “Optimal fitting of transfer functions for parameter identification in industrial robotics” (in Spanish), *Rev. Mét. Num. Ing.*, **5**(3):359-378, 1989
  - 8 Cerrolaza M. y Alarcón E., “A non linear numerical procedure for the evaluation of singular kernels in BEM” (in spanish), *Rev. Int. Mét. Num. en Ing.*, **5**(2):203-218, 1989.
  - 9 Cerrolaza M. and Alarcón E., “The p-adaptive BIEM approach for two-dimensional elasticity”, *J. of Comp. Aided Civil Eng.*, **4**:11-20, 1989.
  - 10 Galante M., Castro J. y Cerrolaza M., “Determination of mesoscale eolic flow in Canary Islands: a practical contribution for the exploitation of alternative energies” (in Spanish), *Rev. Int. Mét. Num. en Ing.*, **6**(2):237-259, 1990.
  - 11 Alarcón E., Cerrolaza M., Madrid A. and Beltran F., “The p-adaptive BIEM version in elastostatics”, *Math. Comp. Model.*, **15**(3-5):23-32, 1991
  - 12 Cerrolaza M., “The p-adaptive boundary integral equation Method”, *Advances in Eng. Soft.*, **15**:261-267, 1992
  - 13 Cerrolaza M. and Aparicio N., “A simple hidden surface algorithm for finite and boundary elements postprocessing”, *Engineering Anal. with Bound. Elem.*, **15**:51-66, 1995
  - 14 Maure A., Cerrolaza M. and Berríos R., “Modelling the behavior of crude oil spills in shallow bodies of water”, *Int. J. of Environ. Soft.*, **10**(4):241-249, 1995.
  - 15 Cerrolaza M., Berríos R. and Bucarito D., “Determination of the Venezuelan coastal zone wind atlas by using numerical methods”, *Int. J. of Wind Eng.*, **19**(4):213-233, 1995.
  - 16 Cerrolaza M., Herrera M., Berríos R. and Annicchiarico W., “A comparison of the hydrodynamical behavior of three heart aortic prostheses by numerical methods”, *J. of Med. Eng. & Tech.*, **12**(6):219-228, 1996.
  - 17 Videla L., Cerrolaza M. and Aparicio N., “Explicit integration of the stiffness matrix of a four-noded-plane elasticity finite element”, *Comm. in Num. Meth. in Eng*, **12**:731-743, 1996
  - 18 Cerrolaza M. and Delage P., “Microstructure And Volume Change Behaviour of Soft Soils: A Boundary Element Simulation”, *J. of Num. and Anal. Meth. in Geomech*, **21**:665-686, 1997
  - 19 Cerrolaza M. and García R., “Boundary elements and damage mechanics to analyze excavations in rock mass”, *Engineering Anal. with Bound. Elem.*, **20**:1-16, 1997
  - 20 Gatmiri B., Delage P. and Cerrolaza M., “UDAM: a powerful FEM software for the analysis of unsaturated porous media”, *Advances in Eng. Soft.*, **20**:334-345, 1998
  - 21 Annicchiarico W. and Cerrolaza M., “Optimization of Finite Element Bidimensional Models: An Approach Based On Genetic Algorithms”, *Fin Elem Anal. Des*, **29**(3-4):231-257, 1998
  - 22 Cerrolaza M., Sulem J. and Elbied A., “A Cosserat non-linear finite element analysis software for blocky structures”, *Advances in Eng. Soft*, **30**(1):69-83, 1998
  - 23 Krafczyk M., Cerrolaza M., Schultz M. and Rank E., “Analysis of 3D transient blood flow passing through artificial aortic valves by Lattice-Boltzmann methods”, *J. of Biomechanics*, **31**(5): 453-462, 1998
  - 24 Flórez J., García R. and Cerrolaza M., “A boundary element approach for a class of non-local damage models”, *Int. J. of Solids and Struct.*, **36**(24):3617-3638, 1999
  - 25 Annicchiarico W. and Cerrolaza M., “Finite Elements, genetic Algorithms and  $\beta$ -spline curves: a Combined Powerful Technique for Shape Optimization”, *Finite Elem. in Anal. and Design.*, **33**(2):125-141, 1999
  - 26 Annicchiarico W. and Cerrolaza M., “A structural optimization approach and software based on genetic algorithms and finite elements”, *Engineering Optimization*, **32**(1):1-31, 1999
  - 27 Marinilli A. and Cerrolaza M., “Computational stochastic analysis of earth-structure

- settlements”, *Computers and Geotechniques*, **25(2)**:107-121, 1999
- 28 Cerrolaza M., Annicchiarico W. and Martínez M., “Optimization of 2d boundary element models using  $\beta$ -splines and genetic algorithms”, *Eng Anal. Bound. Elem*, **24(5)**:427-440, 2000
  - 29 Maldonado Z., Bendayán J, Cerrolaza M. y Kinzbrunner D., “Comparative analysis of hip prostheses using FEM” (in spanish), *Rev. Int. Met. Num. Anal. & Dis*, **16(4)**:395-420, 2000
  - 30 R. García, J. Flórez-López and M. Cerrolaza, “Stress analysis in 2D domains using a nonlocal damage model and the BEM” (in spanish), *Rev. Met. Num. Anal. Dis*, **16(2)**:165-183, 2000
  - 31 Contreras G., Cerrolaza M., Martínez M., Falcón O., González C. “Design of a locked intramedullar system for treatments of metacarpal injured bones”, *Acts of Bioengineering and Biomechanics*. **3(2)**:81-86, 2001.
  - 32 Sulem J. y M. Cerrolaza, “Módeles continus pour les structures rocheuses discontinues”, *Revue Francaise de Geotechnique*, **97**, 2001.
  - 33 Annicchiarico W. and Cerrolaza M., “Structural shape optimization 3D finite-element models based on genetic algorithms and geometric modelling”, *Fin. Elem. Anal. and Design*, **37(5)**:403-415, 2001.
  - 34 C. Muller-Karger, C. González, M. H. Aliabadi and M. Cerrolaza, “Three dimensional BEM and FEM stress analysis of the human tibia under pathological conditions”, *J. of Comp. Mod. In Eng. and Sciences*, **2(1)**:1-13, 2001.
  - 35 Sulem J. and Cerrolaza M., “Finite Element Analysis of Indentation Test in Rocks with Microstructure”, *Computers and Geotech.*, **29(2)**:95-117, 2002
  - 36 Videla L., Cerrolaza M. and González C., “3D modelling, FEM analysis and manufacturing of external fixators for human-bone fractures”, *J. of Comp. Appl. Tech*, **15(3)**:109-121, 2002.
  - 37 Annicchiarico W and Cerrolaza M, “An evolutionary approach for the shape optimization of general boundary element models”, *Electronic J. of Bound Elem*, **2**, 2002
  - 38 C. Muller-Karger, E. Rank and M. Cerrolaza, “P-version of the finite element method for highly heterogeneous simulation of human bone”, *Fin Elem. in Anal. and Des*, **40 (7)**:757-770, 2004.
  - 39 Annicchiarico W. and Cerrolaza M., “A 3D boundary element optimization approach based on genetic algorithms and surface modelling”, *Eng. Anal. With Bound. Elem*, **28(11)**:1351-1361, 2004.
  - 40 R. Curiel, J. Pérez, E. Torres, R. Landaeta and M. Cerrolaza, “Operative contractility: a functional concept of the inotropic state”, *J. of Clinical and Exp. Pharmacology and Phisiology*, **32**:871-881, 2005
  - 41 G. Contreras, M. Cerrolaza, M. Martínez, N. Götzen. “Design, analysis and fabrication of an internal fixation system for metacarpal fractures” (in spanish), *Rev. Int. Mét. Num. Cál. Dis. Ing*, **21(3)**:273-285, 2005.
  - 42 Lozada I., Osorio J. C., Griffiths D. V., Cerrolaza M., “Semi-analytical integration of the 8-node plane element stiffness matrix using symbolic computation”, *Num. Meth. in Partial Diff. Equations*, **22(2)**:296-316, 2006.
  - 43 O. Pelliccioni, M. Cerrolaza y M. Herrera, “Three dimensional analysis of the fluid-structure interaction in bileaflet heart valve using the generalized equation of Lattice Boltzmann” (in spanish), *Rev. Int. Met. Num. Cál. Dis. Ing.*, **22(4)**:377-392, 2006.
  - 44 Martínez G. and Cerrolaza M., “A bone adaptation integrated approach using BEM”, *Eng. Anal. With Bound. Elem*, **30**:107-115, 2006.
  - 45 G. Martínez, J. García, M. Doblaré, M. Cerrolaza, “External Bone Remodeling Through Boundary Elements and Damage Mechanics”, *J. of Math. and Comp in Simul*, **73(1-4)**:183-



199, 2006

- 46 Annicchiarico W., Martínez G., Cerrolaza M., “Boundary elements and B-spline modeling for medical applications”, *J. of App. Math. Mod*, **31(2)**:194-208, 2007
- 47 Annicchiarico W., Cerrolaza M., “Identification of the dynamical properties of structures using free vibration data and distributed genetic algorithms”, *Engineering Optimization*, **39(8)**:969-980, 2007
- 48 Pelliccioni O., M. Cerrolaza y M. Herrera, “Lattice Boltzmann dynamic simulation of a mechanical heart valve device”, *J. of Math and Comp in Simulation*, **75(1-2)**:1-14, 2007
- 49 D. Ojeda, E. Divo, A. Kassab and, M. Cerrolaza, “Detection of cavities in elastostatic problems using genetic algorithms and the BEM” (in spanish), *Rev. Int. Met. Num. Cál. Dis. Ing.*, **23(4)**:363-377, 2007.
- 50 L. Videla, T. Baloa, D. V. Griffiths, M. Cerrolaza, “Exact integration of the stiffness matrix of an 8-node plane elastic finite element by symbolic computation”, *Numerical Methods for Partial Differential Equations*, **24(1)**:249-261, 2008
- 51 Y. González, C. González, M. Cerrolaza, ”The boundary element method in the modeling of bone fractures” (in spanish), *Rev. Int. Met. Num. Cál. Dis. Ing.*, **24(2)**, 2008.
- 52 Gámez B., Ojeda D., Divo E., Kassab A., Cerrolaza M., Parallelized iterative domain decomposition boundary element method for thermoelasticity in piecewise non-homogeneous media, *Eng. Analysis with Boundary Elements*, **32**:1061-1073, 2008
- 53 O. Pelliccioni, M. Cerrolaza, R. Surós y M. Herrera, “A biofluid dynamic computer code using the general lattice Boltzmann equation”, *J. Adv. in Eng. Soft.*, **39(7)**:593-611, 2008
- 54 Ojeda D., Divo E., Kassab A., Cerrolaza M., Cavity detection in biomechanics by an inverse evolutionary point load and BEM technique. *J. of. Inverse Problems in Sci. and Eng.* **16(8)**:981-993, 2008
- 55 Contreras G, Gonzalez C and Cerrolaza M, Intramedullary locked nail for thumb fractures using finite elements, *J. Biomed. Eng. And Tech.* **2(4)**:332-343, 2009
- 56 Y. González, M. Cerrolaza, Poroelastic analysis of bone tissue differentiation by using the boundary element method, *J. of Eng. Anal. Boundary Elements*, **33(5)**:731-740, 2009
- 57 Lozada I, Griffiths V., Cerrolaza M, Semianalytical integration of stiffness matrix of a 8-noded axisymmetric finite element, *J. Num Meth for Partial Differential Equations*, **26(6)**:1624-1635, 2010
- 58 Gámez B., Divo E., Kassab A., Cerrolaza M., Evaluation of fatigue crack growing in cortical bone using the boundary element method, *Int. J. of Healthcare Tech. & Manag.*, **11(3)**:202-221, 2010
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 Authors: Curiel R, Landaeta R, Herrera M, Cerrolaza M.  
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2. Title: *A laparoscopic surgery simulator to train medical doctors* (in Spanish)  
 Authors: M. Cerrolaza, O. Falcón, R. Miquilarena  
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More than 120 papers in conference proceedings in countries such as: Japan, USA, Canada, Finland, Austria, Germany, France, Spain, Italy, Portugal, Belgium, Slovenia, Poland, UK, Australia, Korea, India, China, Venezuela, Mexico, Cuba, Argentina, Brazil, Colombia, Chile and Peru (only selected papers are shown):

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## STUDENTS SUPERVISION

### *Degree Theses*

More than 35 engineer degree theses during the last 25 years, in the fields of numerical methods, finite elements, boundary elements, computational biomechanics, biofluids, alternative energies, optimization.

### *Magister of Science Theses*

1. Numerical evaluation of the eolic potential in Venezuelan coastal zones, Ing. R. Berríos, 1995
2. Boundary element method and damage mechanics for the analysis and design of tunnels excavated in rock, Ing. R. García, 1995
3. Structural optimization using genetic algorithms, Prof. W. Annicchiarico, 1995
4. Elastoplastic analysis of 3D structural models using the FEM, Ing. L. Carestia, 1996
5. Analysis and design of external fixators for human bone fractures by FEM, Prof. L Videla, 1997
6. A comparative analysis of hip prostheses by FEM, Ing. Z. Maldonado, 1999
7. Numerical analysis of artificial heart valves in aortic position with the Lattice Boltzmann method, Prof. R. Landaeta, 1999
8. Analysis, design and manufacturing of external fixators with dynamic transportation by using FEM, Prof. G. Martínez, 2000
9. Analysis, design and manufacturing of internal plates for distal human radius by FEM, Prof. C. Tovar, 2000
10. Analysis and design of an adjustable screw system for proximal femur fractures, Ing. R. Callarotti, 2001
11. Analysis, design and manufacturing of a external fixator for fractures in the human wrist, Ing. M. Gudiel, 2001
12. A semicoupled geomechanic FEM model for the analysis of oil reservoirs, Ing. Amorer, 2002
13. Analysis, design and manufacturing of a spine extensor in lumbar zone, Ing. A. Caprilli, 2002
14. Numerical simulation and design of plates for fractures in the spine, Ing. K. Rojas, 2003
15. Stress evaluation in oil tankers and big ships by using MEF, Ing. J. Torrealba, 2004
16. Analysis and design of an intramedular nail for long bone fractures, Prof. G. Velázquez, 2006
17. Design and manufacturing of an internal device for the treatment of scoliotic spines, Ing. M. Caffiero, 2007
18. Analysis, design and manufacturing of an intervertebral fixator by FEM, Ing C. Rachwan, 2008
19. A new three dimensional model of the human foot, Prof. L. Martino, 2009



20. Generation of discrete tissue models using pre and postprocessing of medical images, Ing. G. Gavidia, 2010
21. Computational analysis and FEM evaluation of a TKR tibial component, Ing. N. Mangado, 2011

#### *Doctoral Theses*

1. Optimization of 2D and 3D finite element models by using genetic algorithms and geometric design, Prof. W. Annicchiarico, 2000
2. Finite Elements and Cosserat Theory to the analysis of indentation rock testing (in French), 1999, Eng. A. El-Bied (coadvised with Dr. J. Sulem, ENPC, France)
3. Biodegradable polymers for controlled drug delivery in bone pathologies, Prof. M. Tortolero, 2001 (coadvised with Dr. G. Arribas)
4. Highly heterogeneous human bone simulation by the finite element method p-version, Prof. C. Muller-Karger, 2002
5. External bone remodeling using the boundary element method, Prof. G. Martínez, 2004
6. Bone remodeling considering mechanical and biological factors, Eng. M. Zeman, 2005
7. 3D analysis of artificial heart valves using Lattice Boltzmann methods, Prof. O. Pelliccioni, 2005
8. Design and manufacturing of a metacarpian intramedullary locked nail, Prof G. Contreras, 2006
9. A model for bone regeneration using the boundary element method, Prof. Y. González, 2007
10. Cavity detection and pathologies in cortical bone using BEM, Prof. D. Ojeda, 2008
11. Symbolic integration of stiffness matrices of axisymmetric finite elements, Prof. I. Lozada, 2008
12. Fatigue crack growth in cortical bone by using the BEM, Prof. B. Gámez, 2009
13. Semi-analytical integration of 2D and 3D finite elements using symbolic computation, Prof. J. Osorio, 2009

#### *Postdoctoral fellows*

1. J. Cegoñino (Spain), 3 months, 2003, *3D mesh generation for complex-shaped bones.*
2. D. d'Amico (Argentina), 6 months, 2005, *Simulation of bone tissue and bone reconstruction.*
3. C. Parvina (Peru), 6 months, 2006, *Boundary elements applied in bone mechanics.*
4. Y. González (Venezuela), 9 months, 2008, *Development of algorithms for callus formation.*

### **FUNDING I+D: RESEARCH PROJECTS**

Since 1994, M. Cerrolaza has been the PI or Co-PI in over 23 RTD projects supported by European, Venezuelan and USA institutions and government agencies. Ten of these projects were supported by Venezuelan Institutions. During the last 18 months, while in CIMNE, seven new projects were formulated and submitted for funding in the European Community, Spanish government and agencies, National Science Foundation (USA) and Interamerican Development Bank (USA). Three of them (Total.Knee, Crusb and Pasi-Bio) have already been funded, while other four projects are pending for funding.

#### *Projects pending for funding in Europe and USA*

1. **ALFA-ELANBE: European-Latinoamerican Network for Bioengineering**  
*Development of new designs and analysis of biomedical prototypes and health new technologies for Latinamerica.*  
 Support: European Community (Alfa III Program). 2011-2013 (submitted)  
 Participants: B. Schrefeler (European PI, Italy), M. Cerrolaza (Iberoamerican PI, CIMNE) and other countries as: Portugal, UK, Spain, Bolivia, Cuba, Perú, El Salvador, Argentina,

- Brazil, Colombia.  
Amount: 1.400.000 €
2. **SAIBE project**  
*Symbolic and analytical integration of boundary elements for large engineering applications*  
Support: Minister for Science and Technology (DFG-Germany). 2011 (submitted)  
Participants: L. Lehmann (Univ of Braunschweig, Germany) and M. Cerrolaza (CIMNE)  
Amount: 60.000 €
  3. **CYTED project**  
*Development and support of new technologies for bioengineering and health technologies for public hospitals in Iberoamerica*  
Support: CYTED (Spanish Government). 2011 (submitted)  
Participants: M. Cerrolaza (PI, CIMNE) and other countries as: Peru, Brazil, Argentina, Mexico, Colombia  
Amount: 40.000 €
  4. **NEWPROST project**  
*Towards a new generation of prosthesis for traumatology*  
Support: European Research Council (FP7-Advanced Grants). 2012-2016 (Passed Step 1 with rank A)  
Participants: M. Cerrolaza (PI-CIMNE)  
Amount: 2.465.200 €
  5. **Am<sup>4</sup>TiReS project**  
*Advanced Mathematical Methods and Computer Modeling for Tissue Regeneration and Scaffolds Manufacturing*  
Support: Fundació La Marató TV3. Catalanian Region (in evaluation). 2012-2014  
Participants: M. Cerrolaza (CIMNE), S. Oller (CIMNE), C. Domingo (CSIC)  
Amount: 361.875 €

*Projects supported by European institutions*

6. **Monuments under seismic actions**  
*Analysis and study of European historic monuments (The Parthenon) subjected to seismic actions*  
Support: European Community. 1995-1997  
Participants: J. Sulem (CERMES-ENPC, Paris), I. Vardoulakis (National Technical University of Athens), M. Cerrolaza (Central Univ of Venezuela) and G. Mulhaus (Australia)  
Amount: 160.000 €
7. **Analysis of dams and earth structures**  
*Numerical analysis and design of earth structures for civil engineering applications.*  
Support: Electricité de France and French Ministry for Science and Education. 2000-2003  
Participants: P. Delage (CERMES-ENPC, France), M. Cerrolaza (Univ. Central de Venezuela), B. Gatmiri and J. Yun Cui (CERMES-ENPC, France)  
Amount: 195.000 €
8. **ALFA-ELBENET: European-Latinoamerican Network for Boundary Elements**  
*Development of boundary element mathematical and computational tools and research in Europe and Latinamerica*  
Support: European Community (ALFA program). 2001-2003  
Participants: V. Leitao (Main coordinator, Portugal), M. Cerrolaza (Coordinator for Venezuela) and other countries as: Spain, France, Portugal, Germany, Greece, Brazil, Argentina, Uruguay, Peru  
Grant N°: AML/B7-311/97/0666/II-0357-FA-FCD-FI, Amount: 1.100.000 €

9. **VIRTUAL-ROOMS CIMNE Project**

*Development and promotion of scientific knowledge and numerical methods in Iberoamerican countries*

Support: Government of Catalonia. 2003-present

Participants: E. Oñate (Main coordinator (Spain), M. Cerrolaza (Bioengineering PI, CIMNE) and other countries as: Cuba, Mexico, Colombia, Argentina, Peru, Chile, Brazil.

Amount: 25.000 €(per year)

10. **CRUSB Project**

*Computational simulation and finite element analysis of bone pathologies and prosthesis with advanced numerical methods*

Support: Minister of Science and Education. Spanish government. 2011-2012

Participants: M. Cerrolaza (PI, CIMNE), E. Oñate (CIMNE)

Grant N°: SAB-2010-0096, Amount: 35.500 €

11. **TOTAL.KNEE project**

*Towards a new generation of knee prosthesis with enhanced lifespan using advanced numerical methods*

Support: European Community, FP7-PEOPLE-2011-CIG-303861

Participants: M. Cerrolaza (PI, CIMNE)

Amount: 100.000 €

*Projects supported by USA agencies (National Science Foundation and IDB)*

12. **SYMBOLIC project**

*Symbolic and analytical integration of finite element stiffness and mass matrices*

Support: National Science Foundation (NSF, USA). 2003-2006

Participants: V. Griffiths (PI, USA), M. Cerrolaza (Co-PI, Venezuela)

Grant N°: INT-0106665, Amount: 32.500 US\$

13. **ProThumb project**

*Design and fabrication of prototypes and prosthesis for traumatology and orthopedics*

Support: Interamerican Development Bank (IDB-USA). 2012-2014 (passed first round, waiting for funding)

Participants: M. Cerrolaza (PI, CIMNE)

Amount: 175.000 US\$ (per year for three years)

14. **PASI-Bio project**

*Training and research in bioengineering and numerical methods*

Support: National Science Foundation (NSF, USA). 2012-2013

Participants: V. Griffiths (USA PI, CSM), M. Cerrolaza (Co-PI, CIMNE), L. Nallim (Argentina), B. Castañeda (Perú)

Grant N°: OISE-1124569/2011, Amount: 100.000 US\$

*Projects supported by Venezuelan institutions (public calls)*

15. **AROM project**

*Analysis and design of modified bipolar hip prostheses*

Support: Research Division, Venezuelan Ministry of Public Health. 1998-2002

Main Coordinator: M. Cerrolaza (PI)

Grant N°: DGS-537-98, Amount: 42.000 €

16. **CARDIOMA project**

*Design of new models for artificial heart valves and blood flow study*

Support: Research Division, Venezuelan Ministry of Public Health. 1999-2001

Main Coordinator: M. Cerrolaza (PI)

Grant N°: DGS-538-99, Amount: 25.000 €

**17. ALDEBARAN project**

*Design of prosthesis and external fixators for fractures in human long bones*

Support: Ministry of Science and Technology. 1998-2002

Main Coordinator: M. Cerrolaza (PI)

Grant N°: S1-9600-1344, Amount: 105.000 €

**18. TOAT project**

*A virtual-reality based framework to assist clinicians and engineers in traumatology implantation.*

Support: Ministry of Science and Technology. 2008-2011

Co-responsible: M. Cerrolaza (Co-PI, Senior researcher)

Grant N°: S1-2001000733, Amount: 58.400 €

**19. LAPAROS project**

*Design of devices and simulators used in laparoscopic surgery*

Support: Ministry of Superior Education. Council for Scientific Development. 2004-2006

Main Coordinator: M. Cerrolaza (PI)

Grant N°: PTP-08.12.5294-2004, Amount: 69.500 €

**20. HIP project**

*Analysis and design of new prototypes of hip prostheses for pathological bone.*

Support: Ministry of Superior Education. Council for Scientific Development. 2008-2010

Main Coordinator: M. Cerrolaza (PI)

Grant N°: PG-08-7301-2008, Amount: 32.000 €

**21. SPINE project**

*Analysis, design and manufacturing of stabilization prostheses for human spine*

Support: Ministry of Superior Education. Council for Scientific Development. 2002-2004

Main Coordinator: M. Cerrolaza (PI)

Grant N°: PG-09-6083-2005, Amount: 28.000 €

**22. GENUS project**

*Design of new models of knee prostheses by using the FEM*

Support: Ministry of Superior Education. Council for Scientific Development. 2002-2004

Main Coordinator: M. Cerrolaza (PI)

Grant N°: PG-08-4222-2002, Amount: 34.000 €

**23. RHEIA project**

*Development of new mathematical algorithms for bone remodeling and callus formation by using BEM*

Support: Ministry of Superior Education. Council for Scientific Development. 2007-2010

Main Coordinator: M. Cerrolaza (PI)

Grant N°: PI-08-5403-2007, Amount: 22.000 €

**24. PIEZOELECTRIC project**

*Development of boundary elements algorithms for the analysis of piezoelectricity effects in human bone healing*

Support: Academy for Physical, Natural and Mathematical Sciences. 2007-2009

Main Coordinator: M. Cerrolaza (PI)

Amount: 12.500 €

**COOPERATION WITH RESEARCH CENTERS AND UNIVERSITIES**

The scientific activity of M. Cerrolaza has generated cooperation with the following research centers and universities:

1. Institute for Engineering Research of Aragon (Prof. M. Doblare, Univ. of Zaragoza, Spain)

- Computer representation of 3D complex models of bone with finite elements. Several papers published in bone remodeling and damage mechanics for bone. Creation of the International Congresses on Computational Bioengineering (started in 2003).*
2. Colorado School of Mines (Prof. V. Griffiths, USA)  
*Analytical integration of FE stiffness matrices. Several papers published in 2D and axisymmetric superparametric finite elements.*
  3. Institute fur Structural Analysis (Prof. G. Beer, Technische Universitat Graz, Austria)  
*Modeling of human bones using the boundary element method*
  4. Dept. of Mech. and Aerospace Eng. (Prof. M. Denda, State Univ. of New Jersey, USA)  
*Analysis of the piezoelectric effect on the fracture healing of long bones (femur and tibia). Computer simulation of 3D piecewise piezoelectric field on bones.*
  5. Universitat of Braunschweig (Prof. L. Lehmann, Germany)  
*Analytical integration of influence matrices in the boundary element method. Results obtained for quadratic elements and full singular kernels.*
  6. Centre de Recherche en Mecanique de Sols (Prof. P. Delage, Ecole Nationale des Ponts et Chaussees, Paris, France)  
*Numerical methods and software development for the analysis of geomechanical problems. Software for Cosserat plasticity in dynamic and non-linear analysis(Prof. J. Sulem)*
  7. International Center for Numerical Methods in Eng. (Prof. E. Oñate, Prof. S. Idelsohn, Spain)  
*Modeling of knee prosthesis and prosthesis for arthritis in older people. Currently supervision of graduate students on these subjects. Some seminars offered in CIMNE.*
  8. Polytechnic University of Catalonia (Prof. S. Oller, Spain)  
*Study of constitutive models for biological materials. Bone remodeling. Cooperation in modeling MCP prosthesis for arthritis in older people.*
  9. Biomechanics Group (CSM-Golden, Prof. A. Petrella, USA)
  10. University of Entre Rios (Prof. J. Di Paolo, Argentina)  
*Analysis of blood flow using finite elements.*
  11. Lehrstuhl für Computation in Engineering (Prof. E. Rank, Technische Universitat Munchen, Germany)  
*Lattice Boltzmann analysis of complex blood flow passing through artificial valves in arteries. Modeling of finite elements having many different mechanical properties using Nurbs and adaptive FEA.*
  12. Bioengineering Center (Prof. J. Bustamante, Univ. of Medellin, Colombia)  
*Analysis of bioprosthetic cardiac valves.*
  13. University of Brescia (Prof. A. Salvadori, Italy)  
*Cooperation in analytical integration of influence matrices in the boundary element method. Bidimensional parametrization of quadratic elements and symbolic manipulation to get analytical closed forms of the matrices.*
  14. Federal University of Santa Catarina (Prof. E. Fancello, Brazil)  
*Cooperation in numerical algorithms and software development for biomechanics and callus formation.*
  15. Instituto Ortopedici Rizzoli (Prof. M. Viceconti, Italy)  
*Co-organization of the 4<sup>th</sup> International Congress of Computational Bioengineering*
  16. University of Las Villas (Prof. C. Recarey, Cuba)  
*Modeling of complex human bones by using novel approaches based on particle-packing methods. Skull and maxillary bones.*
  17. University of Uberlandia (Prof. S. Goulart, Brazil)  
*Cooperation in 3D simulation of dental prosthesis, including surrounding bone and mandible.*

18. Instituto Superior Técnico (Prof. H. Rodrigues, Portugal)  
*Scientific cooperation in finite element modeling of hip prosthesis and other bones. Co-organization of the 2<sup>nd</sup> International Congress on Computational Bioengineering.*
19. University of Mar del Plata (Prof. A. Cisilino, Argentina)  
*Boundary element analysis of 2D and 3D engineering problems, including damage and fracture mechanics*
20. University of Sidney (Prof. K. Srinivas, Australia)  
*Scientific cooperation in symposia organization, related to biological flow analysis (blood) using finite elements.*

## **LANGUAGES**

English: read, write and speak well

French: read well and acceptable speaking

Portuguese: read and speak well

Spanish: mother tongue

M. Cerrolaza

January 2013