EDGARDO DANIEL CASTRONUOVO

Electrical Engineering Dept.
Carlos III de Madrid University
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CURRENT AREAS OF PROFESSIONAL INTEREST AND RESEARCH

- Optimization Techniques.
- Electrical Markets.
- Renewable Production.
- Energy and Economical Studies.
- Wind-Hydro Production Coordination.

WORK EXPERIENCE

Carlos III of Madrid University
June 2005 to present. Madrid, Spain.
Currently, Associate Professor (I) of the Electrical Engineering Dept. Undergraduate Courses: Electric Power Systems, Electrical Installations and Fundamentals of Electrical Technologies. Graduate course: professor of Optimization Techniques in Electrical Systems, of the Master Degree in Electrical, Electronic and Automatic Engineering's.

INESC Porto (Institute of Systems Engineering and Computers)
October 2002 to May 2005. Oporto, Portugal.
Post-Doctorate Researcher. Development of a methodology to manage output deviations of non-controllable renewable generators through reversible hydro units (external funding of EDP Produção, ENERNOVA, DGE and FCT, in diverse projects). Participation in the specifications of the Economic Scheduling for a MicroGrid Central Controller (EU grants).

University of Porto, Electrical Eng. Dept.
April 2004 to May 2005. Oporto, Portugal.
Substitute Professor of Electrical Power Systems I (undergraduate) and Power System Planning (M.Sc. course).

COPPETEC to CEPEL (Federal Research Centre of Electrical Studies)
June 2000 to September 2002. Rio de Janeiro, RJ, Brazil.
Energy Projects Studies. Development and Maintenance Manager of the computational programs: FLUPOT (large-scale Optimal Power Flow, utilized by the Brazilian operator and all the electric

power utilities of Brazil; versions of this program are used in Argentina, Colombia, Uruguay, Venezuela and others countries) and PREDESP (24-hours hydrothermal optimal dispatch). Technical advisor in optimisation aspects of the CONFINT software (reliability studies).

National University of La Plata (Electrical Eng. Dept.)
April 1994 to December 1995**.** La Plata, Buenos Aires, Argentina.
Auxiliary Professor of Electric Machines Theory I and II, Electrical Engineering Dept.

KALOP S.A. (second national factory of electrical elements)
June 1994 to March 1995. Buenos Aires, Argentina.
Technical Assistance Manager, Supervisor of the Quality Control Department.

National University of La Plata (Electrical Eng. Dept.)
June 1993 to July 1994. La Plata, Buenos Aires, Argentina.
Researcher at the Laboratory of Electrical Industry Elements and Machines (LAMDIE).

Industry Development Bureau of Buenos Aires Province.
August 1988 to June 1994. La Plata, Buenos Aires, Argentina.
Programmer for the implementation and actualisation of Industry Census.

EDUCATION

POST-DOCTORATE: "*An Integrated Renewable Energy Solution Using Wind-Hydro Combination*". May 2005. INESC Porto (Institute of Systems Engineering and Computers), Power Systems Unit, Oporto, Portugal. Supervisor: Prof. João A. Peças Lopes.

PH.D. DEGREE IN ENERGY SYSTEMS: "*On the Application of Interior Points Methods to Optimal Power Flow, with High Performance Computation Techniques*". May 2001. Federal University of Santa Catarina, Electrical Engineering Dept., Florianópolis, SC, Brazil. Supervisors: Prof. Roberto Salgado and Jorge M. Campagnolo. Homologated in Spain for Carlos III de Madrid University.

M.SC. DEGREE IN ELECTRICAL ENGINEERING: "*Optimal Power Flow via Interior-Point Method, with High Performance Computation Techniques*". March 1997. Federal University of Santa Catarina, Electrical Engineering Dept., Florianópolis, SC, Brazil. Supervisors: Prof. Roberto Salgado and Jorge M. Campagnolo.

POST-GRADUATION IN ECONOMICAL ENGINEERING. 1995. National University of La Plata. La Plata, Buenos Aires, Argentina.

ELECTRICAL ENGINEER. 1995. National University of La Plata. La Plata, Buenos Aires, Argentina.

HONOURS AND AWARDS

SENIOR MEMBER OF IEEE.

PUBLICATIONS

BOOKS:

OPTIMIZATION ADVANCES IN ELECTRIC POWER SYSTEMS. E.D. Castronuovo (Editor). Nova Science Publishers, Inc., New York, USA, ISBN 978-1-60456-999-5.

CHAPTERS IN BOOKS:

NON-LINEAR MATHEMATICAL PROGRAMMING APPLIED TO ELECTRIC POWER SYSTEMS STABILITY. C.F. Moyano and E. D. Castronuovo. Chapter of the book *Optimization Advances in Electric Power Systems,* Nova Science Publishers, Inc., New York, USA, in press.

TOOLS FOR THE EFFECTIVE INTEGRATION OF LARGE AMOUNTS OF WIND ENERGY IN THE SYSTEM. Jorge Martínez-Crespo, Jorge L. Angarita, Edgardo D. Castronuovo, Hortensia Amaris and Julio Usaola García. Chapter of the book *Optimization Advances in Electric Power Systems,* Nova Science Publishers, Inc., New York, USA, in press.

WIND ENERGY IN ELECTRICITY MARKETS WITH HIGH WIND POWER PENETRATION. J. Usaola and E. D. Castronuovo. Chapter of the book *Electrical Power Research Trends*, Nova Science Publishers, Inc., New York, USA, ISBN 1-60021-978-0, pp 103-154, 2008.

JOURNAL PUBLICATIONS:

REACTIVE POWER RESPONSE OF WIND GENERATORS UNDER AN INCREMENTAL NETWORK-LOSS ALLOCATION APPROACH. P.M. de Oliveira-de Jesus, E. D. Castronuovo and M.T. Ponce de Leão. *IEEE Transactions on Energy Conversion*, vol. 23, n. 2, June 2008, pp. 612-621.

OPTIMAL CONTROLLABILITY OF WIND GENERATORS IN A DELEGATED DISPATCH. E. D. Castronuovo, J. Martínez-Crespo and J. Usaola. *Electrical Power Systems Research*, vol. 77, n. 10, August 2007, pp. 1442 - 1448

OPTIMUM GENERATION CONTROL IN WIND PARKS WHEN CARRYING OUT SYSTEM OPERATOR REQUESTS. R. G. de Almeida, E. D. Castronuovo and J. A. Peças Lopes. *IEEE Transactions on Power Systems*, vol. 21, n. 2, May 2006, pp. 718 - 725

OPTIMAL OPERATION AND HYDRO STORAGE SIZING OF A WIND-HYDRO POWER PLANT. Edgardo D. Castronuovo, J.A. Peças Lopes. *International Journal of Electrical Power and Energy Systems*, vol. 26/10, pp 771-778, December 2004.

ON THE OPTIMIZATION OF THE DAILY OPERATION OF A WIND-HYDRO POWER PLANT. Edgardo D. Castronuovo, J.A. Peças Lopes. *IEEE Transactions on Power Systems*, v.19, n.3, pp. 1599-1606, August 2004.

ON THE APPLICATION OF HIGH PERFORMANCE COMPUTATION TECHNIQUES TO NONLINEAR INTERIOR POINT METHODS. Edgardo D. Castronuovo, Jorge M. Campagnolo and Roberto Salgado. *IEEE Transactions on Power Systems*, vol. 16, n. 3, pp. 325-331, August 2001.

A LARGEST-STEP CENTRAL-PATH ALGORITHM APPLIED TO THE OPTIMAL POWER FLOW PROBLEM. Edgardo D. Castronuovo, Jorge M. Campagnolo and Roberto Salgado. *Controle e Automação Journal*. Vol. 11, pp. 176-181, Dec. 2000.

CONFERENCES:

ECONOMICAL BALANCES WITHIN A DELEGATE DISPATCH OF RENEWABLE GENERATIONS. E. D. Castronuovo, J. Usaola. *UPEC 2008 (43rd Universities Power Engineering Conference)*, September 2008, Padova, Italy.

CONTROLLABILITY REQUESTS FOR THE SECURE INTEGRATION OF WIND PARKS IN THE SYSTEM (IN SPANISH). E. D. Castronuovo, J. Usaola, P.A. Massa and J.M. Ochoa. *VI WWEC (2007 International Wind Energy Conference and Exhibition)*, October 2007, Mar del Plata, Argentina.

ALTERNATIVES OF REVENUE FOR CORRECTIVE ACTIONS OF WIND GENERATORS IN A DELEGATED DISPATCH. E. D. Castronuovo and J. Usaola. Proceedings of the *IEEE ICCEP 2007 (International Conference on Clean Electrical Power)*, May 21-23, 2007, Capri, Italy. pp. 567 – 573

OPTIMAL REACTIVE POWER PROVISION OF WIND FARMS IN LIBERALIZED MARKETS – A GENERATION VIEWPOINT. P. M. De Oliveira-De Jesús, Edgardo D. Castronuovo and M. T. Ponce de Leão. Proceedings of the *2006 IEEE PES Transmission and Distribution*, May 21-26, 2006, Dallas, Texas, USA.

DELEGATED DISPATCH OF WIND GENERATORS IN SPAIN. E. D. Castronuovo and Julio Usaola. Proceedings of the *2006 EWEC (European Wind Energy Conference)*, Feb. 27-Mar. 02, 2006, Athens, Greece.

IMPROVING WIND PARK OUTPUT CONTROL THROUGH HYDRO STORAGE. Edgardo D. Castronuovo, J.A. Peças Lopes. Proceedings of the *MedPower 2004* (4th Mediterranean Conference on Power Generation, Transmission and Distribution). November 15-17, 2004, Lemesos, Cyprus.

BOUNDING ACTIVE POWER GENERATION OF A WIND-HYDRO POWER PLANT. Edgardo D. Castronuovo, J.A. Peças Lopes. Proceedings of the *PMAPS-2004* (8th. International Conference on Probabilistic Methods Applied to Power Systems). September 13-16, 2004, Ames, Iowa, USA.

MIXED-INTEGER OPTIMIZATION OF THE OPERATION OF A WIND PARK WITH STORAGE ABILITY BY AN INTERIOR POINT METHOD. Edgardo D. Castronuovo, J.A. Peças Lopes. Communication to the *Optimization 2004* (Fifth International Conference on Optimisation). Abstracts Book, pp. 88. July 25-28, 2004, Lisbon, Portugal.

OPTIMIZATION OF THE COMBINED OPERATION OF A WIND PARK AND A REVERSIBLE HYDRO UNIT (IN PORTUGUESE). Edgardo D. Castronuovo, J.A. Peças Lopes. Proceedings of the *ENER'04* (Conference on Renewable Energy on Portugal). May 06-07, 2004, Figueira da Foz, Portugal.

WIND AND SMALL-HYDRO GENERATION. AN OPTIMISATION APPROACH FOR DAILY INTEGRATED OPERATION. Edgardo D. Castronuovo, J.A. Peças Lopes. Proceedings of the *2003 EWEC* (European Wind Energy Conference). June 16–19, 2003, Madrid, Spain.

NEW VERSIONS OF NONLINEAR INTERIOR POINT METHODS APPLIED TO THE OPTIMAL POWER FLOW. Edgardo D. Castronuovo, Jorge M. Campagnolo and Roberto Salgado. Proceedings of the *IEEE T&D 2002* Latin America, São Paulo, Brazil, March 18-22, 2002.

VECTOR PROCESSING OF THE NONLINEAR PREDICTOR-CORRECTOR PRIMAL-DUAL INTERIOR POINT METHOD (IN PORTUGUESE). Edgardo D. Castronuovo, Jorge M. Campagnolo and Roberto Salgado. Proceedings of the *13th. Brazilian Automatic Control Conference* (CBA 2000). September 11-14, 2000. Florianópolis, SC, Brazil.

LEVELWISE ALGORITHM FOR VECTOR PROCESSING OF NONLINEAR PRIMAL-DUAL INTERIOR POINT. Edgardo D. Castronuovo, Jorge M. Campagnolo and Roberto Salgado. Proceedings of the *13th*. *Power System Computation Conference* (13th. PSCC). June 1999. Troncheim, Norway.

OPTIMAL POWER FLOW VIA INTERIOR-POINT METHOD WITH HIGH PERFORMANCE COMPUTATION TECHNIQUES (IN PORTUGUESE). Edgardo D. Castronuovo, Jorge M. Campagnolo and Roberto Salgado. X *Brazilian Congress in Computer Architecture - High Performance Techniques* (X SBAC-PAD). September 1998. Buzios, Brazil.

VECTORIZATION OF NONLINEAR PRIMAL-DUAL INTERIOR-POINT METHOD AND APPLICATION AT OPTIMAL POWER FLOW (IN PORTUGUESE). Edgardo D. Castronuovo, Jorge M. Campagnolo and Roberto Salgado. *XII Brazilian Congress of Automation* (XII CBA). September 1998. Uberlândia, Brazil.

THESIS:

ON THE APPLICATION OF INTERIOR POINTS METHODS TO OPTIMAL POWER FLOW, WITH HIGH PERFORMANCE COMPUTATION TECHNIQUES (in Portuguese). Edgardo D. Castronuovo. *Ph.D. Thesis*. Federal University of Santa Catarina, Electrical Engineering Dept., Florianópolis, SC, Brazil. May 2001.

OPTIMAL POWER FLOW VIA INTERIOR-POINT METHOD WITH HIGH PERFORMANCE COMPUTATION TECHNIQUES (IN PORTUGUESE). Edgardo D. Castronuovo. *M.Sc. Thesis*. Federal University of Santa Catarina, Electrical Engineering Dept., Florianópolis, SC, Brazil. March 1997.

PROJECT EXPERIENCE OUTLINE

European Project: ANEMOS+, ENK5-CT-2002-00665, Advanced Tools for the Management of Electricity Grids with Large-Scale Wind Generation.
January 2008 to June 2011. Research project supported by the Research Directorate General of the European Comission.

Spanish Project: CP06, 2007/04066/001, Investigation on Electrical Grids. New Challenges.
January 2007 to present. Research project supported by the Community of Madrid. Madrid, Spain.

Spanish Project: IEMEL Project, ENE 2006/05192, Integration of the Wind Energy in the Electrical Markets.
January 2007 to present. Research project supported by the Education and Science Ministry of Spain. Madrid, Spain.

Spanish Project: Competitive Strategies for Renewable Energy Bids in a Liberalized Market. The Spanish Case. RENOMER Project, DPI2003-00862
June 2005 to Dezember 2006. Research project supported by the Education and Cience Ministry of Spain. Madrid, Spain.

Optimized Control in the Delegated Dispatches of Renewable Producers.
January 2006 to October 2006. Research project supported by GAMESA Energia. Madrid, Spain.

Combined Operation of Wind Parks and Reversible Hydro Units in the North of Portugal
May 2004 to June 2005. INESC Porto – EDP Produção (larger Portuguese generation utility) – ENERNOVA (larger Portuguese wind parks owner). Oporto, Portugal.

Energy Attribution Requirements of New Wind Parks Projects
February 2003 to September 2003. INESC Porto – DGE (Portuguese energy regulator). Oporto, Portugal.

Portuguese Project: DIPTUNE POCTI/41614/ESE/2001, FCT, Portugal.
(analysis of capacity ancillary services in distributed power production)
October 2002 to June 2005. INESC Porto – FCT. Oporto, Portugal.

European Project: MICROGRIDS NNE5-2001-00463, WPC, European Union.
(interconnection of small, modular generation sources to low voltage distribution systems)
October 2002 to January 2003. Research project supported by the Research Directorate General of the European Commission.

Optimal Power Flow with a Large Set of Contingencies
December 2000 to September 2002. CEPEL - COPPETEC - ONS (Brazilian electrical operator)- Furnas (Brazilian generator) – CH São Francisco (Brazilian generator). Rio de Janeiro, RJ, Brazil.

Hydrothermal Optimal Power Flow Based on Interior Point Non-linear Programming
June 2000 to September 2002. CEPEL-COPPETEC-ONS. Rio de Janeiro, RJ, Brazil.

Reliability Analysis in Hydro-Thermal Systems
June 2000 to September 2002. CEPEL-COPPETEC-ONS-Furnas. Rio de Janeiro, RJ, Brazil

Analysis of New Versions of Non-linear Interior Point Methods. Applications in the OPF
March 1997 to December 2000. Federal University of Santa Catarina – CNPq. Florianópolis, SC, Brazil

Competition in the Electric Market: Utilization of the Optimal Power Flow
September 1997 to June 2000. Federal University of Santa Catarina – CNPq. Florianópolis, SC, Brazil.

Application of High Performance Computation Techniques in the Optimal Power Flow
March 1996 to June 2000. Federal University of Santa Catarina – RECOPE/FINEP (Cience and Technology Brazilian Ministry). Florianópolis, SC, Brazil.

New Methods of Factorisation in Linear Systems Resolution
June 1995 to March 1996. Federal University of Santa Catarina – CAPES – RECOPE. Florianópolis, SC, Brazil.

Ergonomic Analysis of the Assembly Dept.
June 1994 to March 1995. KALOP S.A. - National University of La Plata. Buenos Aires, Argentina.

Analysis of Short-Circuit Current in Commercial Electrical Motors
July 1993 to March 1995. National University of La Plata. Buenos Aires, Argentina.

SOCIETIES MEMBERSHIP

IEEE (Institute of Electrical and Electronics Engineers, Inc.), USA
Senior Member of the Power Engineering Society.

TECHNICAL REVIEWER

IEEE, Transactions on Power Systems

IEEE, Transactions on Energy Conversion

IEEE, Transactions on Power Delivery

IET Renewable Power Generation

IET Generation, Transmission and Distribution

International Journal of Electrical Power and Energy Systems (Elsevier Science Ltd.)

Diverse Power System Conferences: PSCC'08, IEEE PSCE 2006, 2006 IEEE PES T&D Latin America, PSCC'05 (15th Power Systems Computation Conference), PMAPS 2004 (8th

International Conference on Probabilistic Methods Applied to Power Systems), among others.

TRAINING AND COURSES, INSTRUCTOR

Production and Distribution of Energy in Airports. Instructor of AENA (Spanish Airports and Air Navigation Association).
Different editions, from February 2006 to today. Madrid, Spain.

Water Pumping Storage to Help Managing System Operation. In the EES-UETP Course: "Managing Power Systems with Large Scale Integration of Wind Generation". Instructor.
March 2004. Oporto, Portugal.

Optimal Power Flow by Interior Point Methods. UNLP (National University of La Plata). Instructor.
October 2002. La Plata, Buenos Aires, Argentina.

Applications of Optimization in Power Systems. I IEEE SPAC. UFJF (Federal University of Juiz de Fora). Instructor.
July 2002. Juiz de Fora, MG, Brazil.

GOVERNMENTAL POSTGRADUATE GRANTS

Science and Technology Foundation (FCT), Science and Technology Ministry, Portugal
October 2002 – May 2005.

National Council of Scientific and Technological Development (CNPq), Brazil
March 1997 – June 2000.

Foundation for the Improvement of the University Members (CAPES), Brazil
March 1995 – March 1997.

APPROVED CONCOURSES

CEPEL (Federal Research Centre of Electrical Studies - Eletrobrás), Brazil
Level 4 Researcher (Doctorate). Results published in the Diário Oficial do Brasil, nº 64, Secção 3, April 4, 2002.

LAST COURSES AND CONGRESSES

UPEC 2008 (43rd Universities Power Engineering Conference).
1-4 September 2008, Padova, Italy

IEEE ICCEP 2007 (International Conference on Clean Electrical Power).
May 21-23, 2007, Capri, Italy

MedPower 2004 (4th Mediterranean Conference on Power Generation, Transmission and Distribution).
November 15-17, 2004, Lemesos, Cyprus

Optimization 2004 (fifth international conference on optimisation).
July 2004, Lisbon, Portugal.

EES-UETP Course: "Managing Power Systems with Large Scale Integration of Wind Generation". Instructor.
March 2004. Oporto, Portugal.

2003 EWEC (European Wind Energy Conference).
June 2003, Madrid, Spain.

EES-UETP Course on Integration of Renewables and Chp, Guarantee of Supply and Ancillary Services in Electricity Markets (EES-UETP / INESC Porto).
November 2002. Oporto, Portugal.

I Colloquium in Continues Optimization (Federal University of Rio de Janeiro).
July 2002. Rio de Janeiro, RJ, Brazil.

IEEE T&D 2002 Latin America.
April 2002. São Paulo, SP, Brazil

XIII CBA (Brazilian Congress of Automation)
September 2000**.** Florianópolis, SC, Brazil

X SBAC-PAD (Brazilian Congress in Computer Architecture - High Performance Techniques)
September 1998. Búzios, RJ, Brazil

XII CBA (Brazilian Congress of Automation)
September 1998. Uberlândia, MG, Brazil

High Performance Processing in Brazil
November 1997. Florianópolis, SC, Brazil

XIII CIGRE-SNPTEE (CIGRE - National Seminary of Production and Transmission of Electrical Energy)
October 1995. Camboriu, SC, Brazil

Science and Technology Seminary
November 1994. Berisso, Buenos Aires, Argentina

PERSONAL DATA

Italian and Argentinean citizenships. Born in Gral. Belgrano, Buenos Aires, Argentina. Married.

Idioms: Spanish, Portuguese, Italian and English.

(JULY 2008)