

## SHORT RESUME

**Name:** Manuel A. Duarte-Mermoud.

**Office Address:**

Facultad de Ingeniería y Arquitectura,  
Universidad Central de Chile  
Santiago - CHILE  
Phone: +562 998252113  
E-mail: [manuel.duarte@ucentral.cl](mailto:manuel.duarte@ucentral.cl)



**Date and Place of Birth:** February 17, 1951 (Santiago, Chile).

**Country of Citizenship:** Chile.

**Marital Status:** Married, three daughters.

**Present Position:**

- Professor, Facultad de Ingeniería y Arquitectura, Universidad Central de Chile.

**Member of:**

- ACCA (Chilean Association of Automatic Control. National Member of IFAC). Since 1980. Founder member.
- IEEE (The Institute of Electrical and Electronics Engineers). Since 1978. (Life Senior Member).

**EDUCATION:**

**1984-1988** Ph.D. in Electrical Engineering, December 3, 1988, Yale University, New Haven, Connecticut, USA.  
**1984-1986** M.Phil. in Electrical Engineering, December 8, 1986, Yale University, New Haven, Connecticut, USA.  
**1984-1985** M.Sc. in Electrical Engineering, December 7, 1985, Yale University, New Haven, Connecticut, USA.  
**1970-1975** E.E., June 17, 1977, University of Chile, Santiago, Chile.  
**1970-1975** B.Sc. in Electrical Engineering, November 12, 1976, University of Chile, Santiago, Chile.

**MAJOR AREAS OF INTEREST:**

- . Adaptive Systems (Linear/Nonlinear; Ideal/Robust; Integer Order/Fractional Order)
- . System Identification and Parameter Estimation
- . Control and Systems Theory
- . Control Applications to Mining and Chemical Processes, Electric Power Systems, Electrical Machines and Drives, Medical Devices
- . Technology for Automation

**Ph.D. Thesis:** "Stable Direct and Indirect Adaptive Control". Yale University, 1988.

**PROFESSIONAL EXPERIENCE:**

**Full Professor and Director of Research and Graduate Studies Institute:** Facultad de Ingeniería y Arquitectura, Universidad Central de Chile. March 2021 – at Present. Research, Teaching and Administration of Research and Graduate studies at the Facultad de Ingeniería y Arquitectura.

**Full Professor:** Department of Electrical Engineering, Universidad Tecnológica Metropolitana. March 2019 – Dec. 2019. Research, teaching and industrial applications on automation and control.

**Full Professor:** Department of Electrical Engineering, University of Chile. April 2002 – Dec. 2019. Research, teaching and industrial applications on automation and control.

**Member of the Evaluation Committee:** Engineering Faculty, University of Chile, 2017-2019.

**Chairman:** Department of Electrical Engineering, University of Chile. August 2012 – July 2014.

**Director of Academic and Research Affairs:** Engineering Faculty, University of Chile, June 2006-Feb. 2011.

**President of the Evaluation Committee:** Engineering Faculty, University of Chile, 2004-2006.

**Graduate Director:** Department of Electrical Engineering, University of Chile, 2003-2005.

**Associate Professor:** Department of Electrical Engineering, University of Chile. March 1996 – March 2002. Research, teaching and industrial applications on automation and control.

**Member of Graduate Committee:** Graduate Department of the University of Chile, 1998-2001.

**Undergraduate Director:** Department of Electrical Engineering, University of Chile, 1997-1999.

**Assistant Professor:** Department of Electrical Engineering, University of Chile. Sep. 1982 to March 1996. Research and teaching on automation and control.

**Research Assistant:** Department of Electrical Engineering, Yale University. Jun. 1985 to Aug. 1985, and Jan. 1986 to Dec. 88. Research on system identification and adaptive control.

**Teaching Assistant:** Department of Electrical Engineering, Yale University. Sep. 1985 to Dec. 88.

**Project Assistant:** Department of Electrical Engineering, Yale University. Sep. 1984 to May. 1985, and Sep. 1985 to Dec. 1985. Research on system identification and adaptive control.

**Instructor:** Department of Electrical Engineering, University of Chile. Oct. 1979 to Aug. 1982. Research and teaching on automatic control.

**Development Engineer:** Department of Electrical Power Supply, Santiago Metropolitan Railway (METRO). Mar. 1978 to Sep. 1979. Analysis of problems arisen in the setting and operation of Line 2, first stage.

**Field Engineer:** Department of Electrical Construction, Santiago Metropolitan Railway (METRO). Aug. 1977 to Feb. 1978. Supervision of the electric equipment assembling in tracks and stations of Line 2, first stage.

**Consulting Engineer:** Department of Automatic Control, Engineering Consultant Company (SINEL). Aug. 1978 to Jul. 1980. Studies of different public and private projects and proposals. Superior: Víctor Olivares.

**Teaching Assistant:** Department of Electrical Engineering, University of Chile. Mar. 1974 to Dec. 1979. (See Table below).

**Consulting Engineer:** Motor Division, Chilean Industrial Company (CIC). Oct. 1977 to Dec. 1978. Studies of three phase induction motors size reduction.

**Assistant Engineer:** Department of Electrical Engineering, Chilean National Electrical Power Utility Company (ENDESA). Summer 1975 and Summer 1976. Studies and design of electric power sub-stations.

### **MAIN PUBLICATIONS: (Last 10 years)**

His papers in journals WoS (ISI) and their citations updated to September 27, 2020 are as follows: 93 papers WoS (ISI) with 1.577 cites in total; 16.7 average cites/paper and 56.32 average cites/year; H-Index=17. The seven most cited paper have 515; 278; 66; 58; 47; 46 and 44 cites, respectively. In Researchgate it possess in total 2,079 cites and 13,667 lectures. Finally, in Google Scholar his papers have 2,733 cites and it has an H-index of 21. The five most cited papers have 706, 373, 137, 93, 78, 66, and 57 cites, respectively.

1. **Juan Carlos Travieso-Torres**, Manuel A. Duarte-Mermoud, “Normalized Model Reference Adaptive Control Applied to High Starting Torque Scalar Control Scheme for Induction Motors”. *Energies*. May 2022, 15 (10), 3606. 16 pp. <https://doi.org/10.3390/en15103606>. ISSN 1996-1073. WoS(ISI). IF: 5.468 (2020). 5-Year IF: 5.317. (Q1).
2. **Juan Carlos Travieso-Torres**, Manuel A. Duarte-Mermoud, Matías Díaz, Camilo Contreras-Jara, Francisco Hernández, “Closed-Loop Adaptive High-Starting Torque Scalar Control Scheme for Induction Motor Variable Speed Drives”. *Energies* 2022, 15, 3489, 15 pp. (Published: 10 May 2022) <https://doi.org/10.3390/en15103489>. ISSN 1996-1073. WoS(ISI). IF: 5.468 (2020). 5-Year IF: 5.317. (Q1).
3. **Juan C. Travieso-Torres**, Camilo Contreras, Francisco Hernández, Manuel A. Duarte-Mermoud, Norelys Águila-Camacho, Marcos E. Orchard, “Adaptive passivity-based control extended for unknown control direction”, *ISA Transactions*. Vol. 122, March 2022 pp. 398-408. DOI: <https://doi.org/10.1016/j.isatra.2021.04.028>. ISSN 0019-0578. WoS(ISI). IF: 5.468 (2020). 5-Year IF: 5.317. (Q1).
4. **Juan Carlos Travieso-Torres**, Camilo Contreras-Jara, Matias Diaz, Norelys Aguila-Camacho, Manuel A. Duarte-Mermoud, “New Adaptive Starting Scalar Control Scheme for Induction Motor Variable Speed Drives”, *IEEE Transactions on Energy Conversion*, Vol. 37, No. 1. March 2022, pp. 729-736. (Submitted on May 10, 2021, Revised July 4, 2021, Accepted July 10, 2021, Published online August 30, 2021, Final Publication February 15, 2022). ISSN: 0885-8969. WoS(ISI). IF: 4.312 (2020). 5-Year IF: 4.955. (Q1 & Q2). DOI: <https://doi.org/10.1109/TEC.2021.3108664>.
5. **Francisco Ibáñez**, Pedro A. Saa, Lisbel Bárzaga, Manuel A. Duarte-Mermoud, Mario Fernández, Eduardo Agosin, José Ricardo Pérez-Correa, “Robust control of fed-batch high-cell density cultures: a simulation-based assessment”, *Computers and Chemical Engineering*, Vol. 155, Article No. 107545, December 2021, 18 pp. (Available online 15 September, 2021). <https://doi.org/10.1016/j.compchemeng.2021.107545>. ISSN: 0098-1354. **WoS(ISI). IF: 3.845 (2020). 5-Year IF: 3.724. (Q2).**
6. **Lisbel Bárzaga-Martell**, Manuel A. Duarte-Mermoud, Francisco Ibáñez-Espinel, Bastián Gamboa-Labbé, Pedro A. Saa, José Ricardo Pérez-Correa. “A robust hybrid observer for monitoring high-cell density cultures exhibiting overflow metabolism”, *Journal of Process Control*, Vol. 104, No. 8. August 2021, pp. 112-125. (Submitted on November 19, 2020, Revised April 24, 2021, Accepted June 15, 2021, Published online June 30, 2021). DOI: 10.1016/j.jprocont.2021.06.006. ISSN 0959-1524. **WoS(ISI). IF: 3.666 (2020). 5-Year IF: 3.716. (Q2).**
7. **Javier A. Gallegos**, Norelys Aguila-Camacho. Manuel A. Duarte-Mermoud, Juan C. Travieso-Torres and Gustavo E. Ceballos-Benavides, “Switched systems with changing derivation order: Stability and applications”, *Journal of The Franklin Institute*. Vol. 358, No. 7, Mayo 2021, pp. 3943-3963. (Published online March 12, 2021). DOI: 10.1016/j.jfranklin.2021.02.033. ISSN 0016-0032, eISSN: 1879-2693. WoS(ISI). IF: 4.504 (2020). 5-Year IF: 4339. (Q1 & Q2).
8. **Javier A. Gallegos**, Manuel A. Duarte-Mermoud, “Improved performance of identification and adaptive control schemes using fractional operators”, *International Journal of Robust and Nonlinear Control*. Vol. 31, No. 9, 2021; pp. 4118–4130. Special Issue: Homogeneous Sliding-Mode Control and Observation. (Submitted May 21, 2020, Revised version September 16, 2020, Accepted January 31, 2021, Published first online March 08, 2021, Published June 2021). DOI: <https://doi.org/10.1002/rnc.5476>. ISSN 1049-8923. WoS(ISI). IF: 4.406 (2020). 5-Year IF: 4354. (Q1 & Q2).
9. **J.I. Aguilar**, R. Castro-Linares and M.A. Duarte-Mermoud, “Robust formation of mobile robots with synchronization using fractional order sliding modes”. (Accepted September 2020), *Proceedings of the 17TH International Conference on Electrical Engineering, Computing Science and Automatic Control CCE 2020*, Mexico City, Mexico, November 11-13, 2020.
10. **Javier A. Gallegos**, Norelys Águila-Camacho, Manuel A. Duarte-Mermoud, “Robust adaptive passivity-based PI<sup>λ</sup>D control”, *International Journal of Adaptive Control and Signal Processing*. Vol. 34, No. 11, pp. 1572-1589. (Published first on line November 2020). DOI: 10.1002/acs.3167. ISSN 0016-0032. Online ISSN:1099-1115. **WoS(ISI). IF: 2.116 (2019). 5-Year IF: 2.035. (Q3).**

11. **J.A. Gallegos**, N. Aguila-Camacho, M. Duarte-Mermoud, "Vector Lyapunov-like functions for multi-order fractional systems with multiple time-varying delays". Communications in Nonlinear Science and Numerical Simulation. Vol. 83, April 2020, Article 105095, pp. 1113-1132. ISSN: 09473580. DOI: <https://doi.org/10.1016/j.cnsns.2019.105089>. WoS(ISI). IF: 1.549 (2018).
12. **M.A. Duarte-Mermoud**, L. Bázquez, G. Ceballos-Benavides, "Mixed Fractional Order Adaptive Control: Theory and Applications". Proceedings of the 21st IFAC World Congress, (Virtual Congress). Berlin, Germany, July 11-17, 2020. 6 pp.
13. **J.A. Gallegos**, M.A. Duarte-Mermoud, "A dissipative approach to the stability of multi-order fractional systems". IMA Journal of Mathematical Control and Information. Vol. 37, No. 1, March 2020, pp. 143-158. (Published first on line November 01, 2018). <https://doi.org/10.1093/imamci/dny043>. ISSN 0265-0754. **WoS(ISI). IF: 1.000 (2018). 5-Year IF: 1.217.**
14. **N. Aguila-Camacho**, M.A. Duarte-Mermoud, M.E. Orchard, "Fractional order controllers for throughput and product quality control in a grinding mill circuit". European Journal of Control. (Submitted on 23 June 2018. ol. 51, No. 1, Jan 2020, pp. 122-134. ISSN: 09473580. [https:// DOI:10.1016/j.ejcon.2019.08.002](https://doi.org/10.1016/j.ejcon.2019.08.002). WoS(ISI). IF: 1.549 (2018).
15. **A.E. Rodríguez-Mata**, R. Luna, J. R. Pérez-Correa, A. Gonzalez-Huitrón, R. Castro-Linares and M.A. Duarte-Mermoud, "Fractional sliding mode nonlinear procedure for robust control of an eutrophying microalgae photobioreactor". Algorithms, Vol. 13, Issue 3, No. 50, 17 pp., February 2020 . ISSN 1999-4893; <https://doi.org/10.3390/a13030050>
16. **J.C. Travieso-Torres**, M. Vilaragut-Llanes, A. Costa-Montiel, M.A. Duarte-Mermoud, N. Aguila-Camacho, C. Contreras-Jara, A. Álvarez-Gracia. "New adaptive high starting torque scalar control scheme for induction motors based on passivity". Energies. Vol. 13, Issue 5, No. 1276, 15 pp., March-1, 2020. Special Issue Control Strategies for Power Conversion Systems. ISSN 1996-1073. <https://doi.org/10.3390/en13051276>. WoS(ISI). IF: 2.702 (2019) ; 5-Year IF: 2.822 (2019).
17. **J.A. Gallegos**, M.A. Duarte-Mermoud, "A dissipative approach to the stability of multi-order fractional systems", IMA Journal of Mathematical Control and Information. Vol. 37, No. 1, March 2020, pp. 143-158.
18. **N. Aguila-Camacho**, J. Gallegos, M.A. Duarte-Mermoud, "Analysis of fractional order error models in adaptive systems: Mixed order cases", Fractional Calculus and Applied Analysis. Vol. 22, No. 4, 2019, pp. 1113-1132. ISSN: 1311-0454 Print; 1314-2224 Electronic. [https:// DOI: 10.1515/fca-2017-0047](https://doi.org/10.1515/fca-2017-0047). WoS(ISI). IF: 3.514 (2018). 5-year IF: 3.524.
19. **J.A. Gallegos**, N. Aguila-Camacho, M.A. Duarte-Mermoud, "Smooth Solutions to Mixed-Order Fractional Differential Systems with Applications to Stability Analysis". Journal of Integral Equations and Applications, Vol. 31, No. 1, 2019, pp. 59-84. (ISSN: 0897-3962 (print), E-ISSN: 1938-2626. [https:// DOI:10.1216/JIE-2019-31-1-59](https://doi.org/10.1216/JIE-2019-31-1-59). WoS(ISI). IF: 0.974 (2018). 5-year IF: 1.211. <https://projecteuclid.org.uchile.idm.oclc.org/euclid.jiea/1561601026>
20. **J.A. Gallegos**, M.A. Duarte-Mermoud, "On real order passivity". Bulletin of the Polish Academy of Sciences: Technical Sciences. Vol. 67, No. 3, 2019, pp. 445-454. [https://doi: 10.24425/bpasts.2019.128611](https://doi.org/10.24425/bpasts.2019.128611). ISSN 2300-1917 (print), ISSN 0239-7528 (online). WoS(ISI). IF: 1.361 (2018), 5-Years IF: 1.323.
21. **J.A. Gallegos**, M.A. Duarte-Mermoud, "Converse theorems in Lyapunov's second method and applications for fractional order systems". Turkish Journal of Mathematics. Vol. 43, No. 3, 2019, pp. 1626-1639. [https://doi:10.3906/mat-1808-75](https://doi.org/10.3906/mat-1808-75). ISSN 1300-0098, E-ISSN: 1303-6149. WoS(ISI). IF: 0.597 (2018). 5-Year IF: 0.553.
22. **M.A. Duarte-Mermoud**, G.E. Ceballos-Benavides, L. Bázquez, "On the Fractional Order Multiple Models Adaptive Control". Proceedings of the Nineteenth Yale Workshop on Adaptive and Learning Systems. K.S. Narendra Ed., June 10 - 12, 2019, New Haven, Connecticut, USA. pp. 206-211.

23. **T. Crespo**, M. A. Duarte, G. Ceballos, G. Lefranc, "Fractional Order Controllers for Back-to-Back Converters". IEEE Latin America Transactions, Special Issue on New Trends Electronics. Vol. 16, No. 9, Sep. 2018, pp. 2427-2434. DOI: 10.1109/TLA.2018.8528264. ISSN 1548-0992. WoS(ISI). IF: 0.502 (2017).
24. **M. Bustamante**, A. Rienzo, R. Osorio, M. Duarte, G. Lefranc, "Applications of Creme algorithm to radiographic knee images". (In Spanish). Proceedings of the IEEE ICA-ACCA 2018 - IEEE International Conference on Automation and 23rd Congress of the Chilean Association of Automatic Control: Towards an Industry 4.0. Concepción, Chile. 17-19 Oct. 2018. 6 pp. DOI: 10.1109/ICA-ACCA.2018.8609840. e-ISBN: 978-1-5386-5586-3. USB ISBN: 978-1-5386-5585-6. (SCOPUS).
25. **M.A. Duarte-Mermoud**, J.C. Travieso-Torres, T. A. Crespo-Herrera, "Fractional order proportional-integral controller applied to a back-to-back converter". Proceedings of the 22 International Conference on Circuits, Systems, Communications and Computers (CSCC 2018), July 14-17, 2018 Mallorca, España. Vol. 210, 2018, Paper CSCC 2018-172, 6 pp. ISSN: 2261-236X. SCOPUS.
26. **J.A. Gallegos**, M.A. Duarte-Mermoud, "Attractiveness and stability for Riemann-Liouville fractional systems". Electronic Journal of Qualitative Theory of Differential Equations (EJQTDE). Vol. 2018, No. 73, 2018, pp. 1-16. DOI: 10.14232/ejqtde.2018.1.73. ISSN 1417-3875. WoS(ISI). IF: 1.065 (2018). 5-year IF: 1.072. Q1/Q3.
27. **Govea-Vargas**, R. Castro-Linares, M.A. Duarte-Mermoud, N. Aguila-Camacho, G. E. Ceballos-Benavides "Fractional order sliding mode control of a class of second order perturbed nonlinear systems: Application to the trajectory tracking of a quadrotor". Algorithms. Special Issue on "Fractional Order Systems and Signals: Modelling, Identification and Control Applications". Guest Editors, M.A. Duarte-Mermoud, R. Castro-Linares. Vol. 11, No. 9, 2018, Article number 168, 24 pp. ISSN 1999-4893; <https://doi.org/10.3390/a11110168>. ESCI (Emerging Sources) (WoS).
28. **M. A. Duarte-Mermoud**, J. A. Gallegos, R. Castro-Linares, N. Aguila-Camacho, "Mixed order fractional observers for minimal realizations of linear time-invariant systems". Algorithms. Special Issue on "Fractional Order Systems and Signals: Modelling, Identification and Control Applications". Guest Editors, M.A. Duarte-Mermoud, R. Castro-Linares. Vol. 11, No. 9, 2018, Article number 136, 18 pp. ISSN 1999-4893; <https://doi.org/10.3390/a11090136>. ESCI (Emerging Sources) (WoS).
29. **Govea-Vargas**, R. Castro-Linares, N. Águila-Camacho, M.A. Duarte-Mermoud, "Fractional order sliding mode control of a quadrotor". Proceedings of the IASTED International Conference on Modelling, Simulation and Identification (MSI 2018), July 16-17, 2018, Calgary, Canada. Paper No. 857-023, pp. 15-22.
30. **J.A. Gallegos**, M.A. Duarte-Mermoud, "Robust mixed order backstepping control of nonlinear systems". The Institution of Engineering and Technology. Control Theory & Applications, Vol. 12, No. 9, 2018, pp. 1276-1285. <http://dx.doi.org/10.1049/iet-cta.2017.0905>). ISSN 1751-8644 (Print); 1751-8652 (Online). WoS(ISI). IF: 3.526 (2018). 5-year IF: 3.423. Q1/Q2.
31. **J.A. Gallegos**, M.A. Duarte-Mermoud, R. Castro-Linares, "Mixed order robust adaptive control for general linear time invariant systems". Journal of the Franklin Institute. Vol. 355, No.8, May 2018, pp. 3399-3422. DOI: 10.1016/j.jfranklin.2018.02.022). ISSN 0016-0032 (Print). WoS(ISI). IF: 3.653 (2018). 5-year IF: 3.634. Q1/Q2.
32. **M.A. Duarte-Mermoud**, F. Milla, "Power System Stabilizer using Model Predictive Control". (In Spanish). Revista Iberoamericana de Automática e Informática Industrial RIAI, Vol. 15, No. 3, 2018, pp.286-296. DOI: <https://doi.org/10.4995/riai.2018.10056>). ISSN 1697-7912 (Print); 1697-7920 (Online). WoS(ISI). IF: 1.313 (2018). 5-year IF: 0.85. Q3/Q4.
33. **M.A. Duarte-Mermoud**, N. Aguila-Camacho, J.A. Gallegos and J.C. Travieso-Torres, "Fractional Order Model Reference Adaptive Controllers for First Order Integer Plants", in New Perspectives and Applications of Modern Control Theory, in honor of Alexander S. Poznyak. Eds. Julio B. Clempner and Wen Yu. Chapter 6, pp. 121-151. (First Online: 30 September 2017). Springer International Publishing AG, USA, 2018. ISBN 978-3-319-62463-1 (Paper), ISBN 978-3-319-62464-8 (eBook). <https://doi.org/10.1007/978-3-319-62464-8>. Chapter DOI: 10.1007/978-3-319-62464-8\_6.

34. **N. Aguila-Camacho**, M.A. Duarte-Mermoud, M.G. Mayol-Suárez, "Fractional order error models with parameter constraints", in *Mathematical Techniques of Fractional Order Systems*. Eds. Ahmad Taher Azar, Ahmed G. Radwan and Sundarapandian Vaidyanathan. *Series Advances in Nonlinear Dynamics and Chaos (ANDC)*. Chapter 6, pp. 159-183. Elsevier, USA, 2018. <https://doi.org/10.1016/B978-0-12-813592-1.00006-4>. Available online 15 June 2018. ISBN: 978-0-12-813592-1.
35. **J.C. Travieso-Torres**, M.A. Duarte-Mermoud, A. Gutiérrez-Osorio, O. Beytía, "Experimental Comparison of Passivity-Based Controllers for the Level Regulation of a Conical Tank". *Revista Iberoamericana de Automática e Informática industrial RIAI*, Vol. 15, No. 2, 2018, pp.167-173. <https://doi.org/10.4995/riai.2017.8976>. ISSN: 1697-7912 (Print), 1697-7920 (Online). (ISI). IF: 0.44 (2016).
36. **E. Delgado-Aguilera**, M.A. Duarte-Mermoud, N. Aguila-Camacho, "Adaptive synchronization of Lorenz systems using a reduced number of control signals and parameters without knowing bounds on system parameters and trajectories". *IMA Journal of Mathematical Control and Information*, Vol. 35, No. 1, March 2018, pp. 149-164. <http://dx.doi.org/10.1093/imamci/dnw042>. ISSN 0265-0754 (Print); 1471-6887 (Online). WoS(ISI). IF: 1.273 (2016).
37. **M. Ortiz-Quisbert**, M.A. Duarte-Mermoud, F. Milla, R. Castro-Linares, G. Lefranc, "Optimal Fractional Order Adaptive Controllers for AVR Applications". *Electrical Engineering*, Vol. 100, No. 1, 2018, pp. 267-283. DOI 10.1007/s00202-016-0502-2. ISSN: 0948-7921 (Print), 1432-0487 (Online). (ISI). IF: 0.569 (2016).
38. **R. Oróstica**, M.A. Duarte-Mermoud, C. Jáuregui, G. Lefranc, "Inverted Pendulum Stabilization by means of Fractional Order PID Controllers", (In Spanish). *Proceedings of the IEEE CHILECON 2017*, Pucón, Chile, October 18-20, 2017, Paper No. 234, pp. 158-164. ISSN: 0719-6806.
39. **M. Vera**, G. Lefranc, R. Osorio-Comparán, A. Rienzo, M.A. Duarte-Mermoud, "Variables Control of a Modular Greenhouse", (In Spanish). *Proceedings of the IEEE CHILECON 2017*, Pucón, Chile, October 18-20, 2017, Paper No. 278, pp. 190-197. ISSN: 0719-6806.
40. **M.A. Duarte-Mermoud**, N. Aguila-Camacho, "Fractional adaptive systems in the presence of bounded disturbances and parameter variations". *International Journal of Adaptive Control and Signal Processing*. Vol. 31, No. 9, September 2017, pp. 1273–1284. (Submitted June 23, 2016. DOI 10.1002/acs.2763. ISSN: ISSN 1109-2734 (Print), 1099-1115 (Online). **IF: 1.708 (2016)**.
41. **J.A. Gallegos**, M.A. Duarte-Mermoud, "Robustness and convergence of fractional systems and their applications to adaptive schemes". *Fractional Calculus and Applied Analysis*. Vol. 20, No. 4, August 2017, pp. 895–913. Print ISSN: 1311-0454, Electronic ISSN 1314-2224. [https:// DOI: 10.1515/fca-2017-0047](https://doi.org/10.1515/fca-2017-0047). **IF: 2.034 (2016)**.
42. **J.A. Gallegos**, M.A. Duarte-Mermoud, "Convergence of fractional adaptive systems using gradient approach". *ISA Transactions*. Vol. 69, No. 7, July 2017, pp. 31-42. Print ISSN: 0019-0578. <https://doi.org/10.1016/j.isatra.2017.04.021>. **IF: 3.394 (2016)**.
43. **N. Aguila-Camacho**, M.A. Duarte-Mermoud, "Combined Fractional Adaptive Control". *Proceedings of the 20th World Congress of the International Federation of Automatic Control (IFAC 2017)*, July 9-14, 2017, Toulouse, France. Special Session: "Advances in Fractional Calculus. Theory and Applications". pp. 8916-8921.
44. **M.A. Duarte-Mermoud**, N. Aguila-Camacho, M.G. Mayol-Suárez, C.A. Espinoza-Andrades, "On the Fractional Order High-Gain Adaptive Control". *Proceedings of the Eighteenth Yale Workshop on Adaptive and Learning Systems*. K.S. Narendra Ed., June 21 - 23, 2017, New Haven, Connecticut, USA. pp. 62-67.
45. **J.C. Travieso-Torres**, M. A. Duarte-Mermoud, O. Beytía, "Combining fractional order operators and adaptive passivity-based controllers: An application to the level regulation of a conical tank". *Control Engineering and Applied Informatics*. Vol. 19, No.2, June 2017, pp. 3–10. ISSN 1454-8658. **IF: 0.695 (2016)**.

46. **J.C. Travieso-Torres**, M. A. Duarte-Mermoud, O. Beytía-Cancino, “Taylor polynomial approximation and adaptive passivity based control applied to the level regulation of a conical tank”. *Asian Journal of Control*. Vol. 19, No. 5, September 2017, pp. 1722-1730. DOI: 10.1002/asjc.1496. ISSN: 1934-6093 (On line). **ISI, IF: 1.421 (2016)**.
47. **T. Crespo Herrera**, M. A. Duarte-Mermoud, “PI fractional order controller applied to a back to back power converter”. (In Spanish). *Anales del Instituto de Ingenieros de Chile (Annals of the Chilean Institute of Engineers)*, Vol. 129, No. 2, Agosto 2017, pp. 37-47. ISSN: 0716-2340 (Print).
48. **C. Pacheco-Oñate**, M.A. Duarte-Mermoud, N. Aguila-Camacho, R. Castro-Linares, “Fractional-order state observers for integer-order linear systems”. *Journal of Applied Nonlinear Dynamics*. Special Issue on “Fractional Calculus Applications in Modeling and Design of Control Systems”. Guest Editors, M. Ortigueira, P. Ostalczyk, C. Muresan. Vol. 6, No. 2, June 2017, pp. 251-264. <http://dx.doi.org/10.5890/JAND.2017.06.010>. ISSN: 2164-6457 (Print), ISSN: 2164-6473 (Online). **SCOPUS**.
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#### **MAIN PATENTS AND TECHNOLOGICAL PROJECTS:**

- **Solicitud** de patente de invención nacional en Chile INAPI No.2013-0947 del 8 de Abril de 2013, "Dispositivo de Ecografía Portátil y Manual; con Control Lógico y Procesamiento de Datos en una Plataforma Configurada por una Unidad FPGA; con Bloques Lógicos de Hardware Interconectados para formar Módulos de Control General y de Emisión de Pulsos; Un Módulo de Conformación de Ondas y un Módulo de Procesamiento de Imagen; Método para Generar Imágenes con Dicho Dispositivo".  
**Concedida:** 11 de Junio de 2018, vigente hasta el 8 de abril de 8 de abril de 2033.  
**Inventores:** John Mac Kinnon Dahlgren, MKA; Manuel Duarte Mermoud, UCH; Carlos Conca Rosende, UCH; Nicolás Beltrán Maturana, UCH; Rodrigo Maureira Tenorio, Vader Johnson Vera, Javier Moya Fuentes.  
**Beneficiarias:** Universidad de Chile (35%), MegaSalud (33%) y Mac Kinnon y Asociados (32%).
- **Solicitud** de patentamiento de invención internacional PCT/CL2014/000008. (N/Ref. 76550-PCT) Mayo 2014, "Un dispositivo de ecografía portátil y manual, con control y procesamiento centralizado en el hardware y con salidas de visualización y que opera en tiempo real con una alta tasa de refresco en sus imágenes".  
**Inventores:** John Mac Kinnon Dahlgren, MKA; Manuel Duarte Mermoud, UCH; Carlos Conca Rosende, UCH; Nicolás Beltrán Maturana, UCH; Rodrigo Maureira Tenorio, Vader Johnson Vera, Javier Moya Fuentes.

**Beneficiarias:** Universidad de Chile (35%), MegaSalud (33%) y Mac Kinnon y Asociados (32%).

- **Solicitud** de patente de invención en Chile INAPI No. 01053, 30 de Septiembre de 2010, "Sistema de Calentamiento Inductivo de Soluciones para Plantas de Biolixiviación y Electro-Obtención en Altura".  
**Inventores:** Manuel Duarte Mermoud, UCH; Nicolás Beltrán Maturana, UCH; Ian Pelissier Montero, UCH; Ricardo Fuentes Fuentealba, USM; Jorge Juliet Avilés, USM; Patricio Lagos Lehuedé, IDT S.A.; Jorge Estrada González, IDT S.A.; Ricardo Godoy Anderson, AngloAmerican Chile; Alfredo Bernal Rojas, AngloAmerican Chile.  
**Beneficiarias:** Universidad de Chile (29%), Universidad Técnica Federico Santa María (28%), IDT S.A. (25%) y AngloAmerican Chile S.A. (18%).
- **Solicitud** de patentamiento invención internacional PCT/CL N° 2011/00058 del 27 de Septiembre de 2011, "System for the inductive heating of solutions for bioleaching and electrowinning plants at high altitude".  
**Inventores:** Manuel Duarte Mermoud, UCH; Nicolás Beltrán Maturana, UCH; Ian Pelissier Montero, UCH; Ricardo Fuentes Fuentealba, USM; Jorge Juliet Avilés, USM; Patricio Lagos Lehuedé, IDT S.A.; Jorge Estrada González, IDT S.A.; Ricardo Godoy Anderson, AngloAmerican Chile; Alfredo Bernal Rojas, AngloAmerican Chile.  
**Beneficiarias:** Universidad de Chile (29%), Universidad Técnica Federico Santa María (28%), IDT S.A. (25%) y AngloAmerican Chile S.A. (18%).

## **EXTERNALLY FUNDED RESEARCH PROJECTS :**

Soon after my graduation as Civil Electrical Engineer in 1977, I started working as a Field Engineer first and later as a Study Engineer in the Santiago Metro Railways for two years, getting a valuable experience working in a state company. Then, in 1979 I moved to the Electrical Engineering Department of the University of Chile, where I remained until 2019. Beside the teaching duties, I have to apply to different source finding to develop research projects, which include the collaboration of students pursuing their engineering studies, engineers and colleagues.

The following is a list of the main projects I have led or participated, funded by sources external to the Universities I have worked.

- "Development of Fractional Order Tools for Stability, Estimation and Control of Systems and Applications". FONDECYT Project 1190959.  
. Duration: 4 years, 2019 - 2022.  
. Funding Source: National Fund for Scientific and Technological Development, FONDECYT.  
. Allocated Funds: CLP 193,096,000 (USD 275,741)<sup>\*</sup>  
. Responsible Researcher: Manuel Duarte M. (12 hrs./week)  
. Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile and Universidad Central de Chile.

\* See exchange rate at the end of this document.

- "Integral modeling of energy consumption in mineral and metallurgical processes". Project AMTC L3P2.  
. Duration: 5 years, 2014 - 2019.  
. Financial Source: Basal Project FB0809 Advanced Mining Technology Center (AMTC), CONICYT.  
. Allocated Funds: CLP 34,038,477 (2016-2017 period).  
. Responsible Researcher: Manuel Duarte M. (20 hrs./week)  
. Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.
- "CONICYT Link Project Science-Company, Atacama Region".  
. Duration: 2 years, 2014 and 2015.  
. Funding Source: CONICYT.  
. Allocated Funds: CLP 44,477,150.  
. CORPROA Responsible Researcher: Marco Alfaro M. (3 hrs./week)  
. UCH Responsible Researcher: Manuel Duarte M. (3 hrs./week)  
. Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

- “Research to improve the characteristics of an ultrasound equipment, ultra-portable and cost-effective, for medical applications”.
  - . Duration: 2 years, 2014 - 2015.
  - . Funding Source: Basal Project Center for Biotechnology and Bioengineering (CeBiB). CONICYT.
  - . Allocated Funds: CLP 134,612,000.
  - . Responsible Researcher: Manuel Duarte M. (8 hrs./week)
  - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.
  
- “Fractional Error Models in Adaptive Control and Applications”. FONDECYT Project 1150488.
  - . Duration: 4 years, 2015 - 2018.
  - . Funding Source: National Fund for Scientific and Technological Development, FONDECYT.
  - . Allocated Funds: CLP 120,200,000
  - . Responsible Researcher: Manuel Duarte M. (12 hrs./week)
  - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.
  
- “Improvements of Adaptive Systems Performance by Using Fractional Order Observers and Particle Swarm Optimization”. FONDECYT project 1120453.
  - . Duration: 3 years, 2012 - 2014.
  - . Funding Source: National Fund for Scientific and Technological Development, FONDECYT.
  - . Allocated Funds: CLP 85,703,000
  - . Responsible Researcher: Manuel Duarte M. (10 hrs./week)
  - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.
  
- “Energy and Carbon Management Course”. Support Program for the Formation of International Networks between CONICYT-MINENERGIA and Energy Research Centers.
  - . Duration: 2 years, August 2012 - April 2014.
  - . Funding Source: CONICYT
  - . Allocated Funds: CLP 14,864,000
  - . Responsible Researcher: Manuel Duarte M. (10 hrs./week)
  - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.
  
- “Energy Recovery from Mineral Pipelines”. CSIRO Chile-AMTC P5.3 Project,
  - . Duration: 3 years, 2013-2015.
  - . Funding Source: CORFO, CSIRO Chile, AMTC.
  - . Allocated Funds: CLP 200,000,000
  - . Responsible Researcher: Manuel Duarte M. (10 hrs./week)
  - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.
  
- “Development of a Cost-Effective Portable Echograph for Obtaining Body Images in Routine Medical Examinations”. CORFO-INNOVA Project 2009-7183 / 09IEI-7183. Joint project with MacKinnon & Asoc. and MegaSalud companies.
  - . Duration: 3 years, 2011 - 2013.
  - . Funding Source: CORFO-INNOVA.
  - . Allocated Funds: CLP 541,819,000
  - . Responsible Researcher: John MacKinnon (10 hrs./week)
  - . Co-Researchers: Manuel Duarte (8 hrs./week), Nicolás Beltrán and Carlos Conca.
  - . Other Participants: Engineers and Research Assistants of the Department of Electrical Engineering of the University of Chile.
  
- “Design of Fractional Order Adaptive Controller with Applications”. FONDECYT project 1090208.
  - . Duration: 3 years, 2009 -2011.
  - . Funding Source: National Fund for Scientific and Technological Development, FONDECYT.
  - . Allocated Funds: CLP 82,073,000
  - . Responsible Researcher: Manuel Duarte M. (10 hrs./week)
  - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

- “Improvement of Copper Minerals Bioleaching Operations and Electro-obtaining in High Altitude Plants by Heating Solutions by Magnetic Induction”. Project FONDEF D05110098. Joint project with the Department of Electricity of the Universidad T. Federico Santa María, AngloAmerican Chile and IDT S.A.
  - . Duration: 3 years, March 2007-February 2010.
  - . Funding Source: Fund for the Promotion of Scientific and Technological Development, FONDEF.
  - . Allocated Funds: CLP 343,200,000
  - . Managing Director: Manuel Duarte M.
  - . Other Participants: • “Researchers and Research Assistants of the Department of Electrical Engineering of the University of Chile and of the Department of Electricity of the University T. Federico Santa María.
  
- “Technological Consortium Cooperative Center for Viticulture Development (CCDV)“. CORFO-INNOVA (2005-2010). Sub-Project “Intelligent Instrumentation for geographical identification (origin denomination) and quality control of Chilean wines”. Joint project between ChileVid, Universidad de Chile, U.T. Federico Santa María, U. de Talca, Chilean Wine Corporation and National Cooperage. Funded by CORFO Innova.
  - . Duration: 6 years, 2005-2010.
  - . Funding Source: CORFO-INNOVA.
  - . Allocated Funds: CLP 1,530 mill. Corfo (Total 2,300 mill. in total).
  - . Responsible Researcher: Nicolás Beltrán (10 hrs./week)
  - . Co-Researchers: Manuel Duarte (8 hrs./week)
  - . Other Participants: Engineers and Research Assistants of the Department of Electrical Engineering of the University of Chile.
  
- “Design of Adaptive Strategies for Control and Anti-Control of Chaos in Variant and Invariant Nonlinear Systems in Time and Applications.”. FONDECYT Project 1061170.
  - . Duration: 3 years, 2006 - 2008.
  - . Funding Source: National Fund for Scientific and Technological Development, FONDECYT.
  - . Allocated Funds: CLP 41,375,000
  - . Responsible Researcher: Manuel Duarte M. (10 hrs./week)
  - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.
  
- “Theoretical, Simulated and Experimental Study of Nonlinear Adaptive Control Strategies of Electrical Machines”. CONICYT-CITMA 20034064 Project for International Scientific Cooperation.
  - . Duration: 2 years, 2004, 2005.
  - . Funding Source: National Fund for Scientific and Technological Development, FONDECYT.
  - . Allocated Funds: CLP 3,240,000
  - . Responsible Researcher: Manuel Duarte M. (6 hrs./week)
  - . Other Participants: Electro-Energy Research and Testing Center (CIPEL) of the José Antonio Echeverría Higher Polytechnic Institute (ISPJAE), Havana, Cuba. Research Assistants of the Department of Electrical Engineering of the University of Chile.
  
- “Advanced Adaptive Control Schemes for Nonlinear Systems and Applications”. FONDECYT Project Incentive to International Cooperation 7040121.
  - . Duration: 1 year, 2004.
  - . Funding Source: National Fund for Scientific and Technological Development, FONDECYT.
  - . Allocated Funds: CLP 1,500,000
  - . Responsible Researcher: Manuel Duarte M. (6 hrs./week)
  - . Other Participants: Rafael Castro Linares, Center for Research and Advanced Studies of the National Polytechnic Institute, Department of Electrical Engineering, Mechatronics Section, Mexico and Research Assistants of the Department of Electrical Engineering of the University of Chile.
  
- “Advanced Adaptive Control Schemes for Nonlinear Systems and Applications”. FONDECYT Project Incentive to International Cooperation 7030072.
  - . Duration: 1 year, 2003.
  - . Funding Source: National Fund for Scientific and Technological Development, FONDECYT.
  - . Allocated Funds: CLP 1,640,000
  - . Responsible Researcher: Manuel Duarte M. (10 hrs./week)

. Other Participants: Romeo Ortega, Laboratoire de Signaux et Systemes (LSS) of École Supérieure d'Électricité (SUPELEC) in Gif-sur-Yvette, France and Research Assistants of the Department of Electrical Engineering of the University of Chile.

• "Varietal Identification of Chilean Wines through Intelligent Instrumentation". FONDEF D01-1016 Project. Joint project with the Department of Enology and Agroindustries, U. de Chile, Viñas Gulmué, Santa Graciela de Los Alcones and Tabontinaja, Automind, Grupo Interzone, Association of Winemakers of Chile and SAG:

. Duration: 3 years, March 2002-March 2005. (Extension Dec. 2005)

. Funding Source: Fund for the Promotion of Scientific and Technological Development, FONDEF.

. Allocated Funds: CLP 189,000,000

. Managing Director: Nicolás Beltrán M.

. Alternate Director: Eduardo Loyola M.

. Co-Researchers: Manuel Duarte M. (12 hrs./week).

. Other Participants: Researchers and Research Assistants from the Department of Electrical Engineering and Enology and Agroindustries of the University of Chile and the Technological Center of Vine and Wine of the University of Talca.

• "Advanced Adaptive Control Schemes for Nonlinear Systems and Applications". FONDECYT Project 1030962.

. Duration: 3 years, 2003 - 2005.

. Funding Source: National Fund for Scientific and Technological Development, FONDECYT.

. Allocated Funds: CLP 45,874,000

. Responsible Researcher: Manuel Duarte M. (10 hrs./week)

. Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

• "Stabilization, Monitoring and Regulation of Nonlinear Systems using Backstepping and Flatness Techniques". FONDECYT Project 1000937.

. Duration: 3 years, 2000 - 2002.

. Funding Source: National Fund for Scientific and Technological Development, FONDECYT.

. Allocated Funds: CLP 42,892,000

. Responsible Researcher: Manuel Duarte M. (10 hrs./week)

. Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

• "Studies of adaptive passivity and adaptive control in non-linear systems". FONDECYT Project 1970351.

. Duration: 3 years, 1997 - 1999.

. Funding Source: National Fund for Scientific and Technological Development, FONDECYT.

. Allocated Funds: CLP 37,781,000

Responsible Researcher: Manuel Duarte M. (10 hrs./week)

. Co-Investigators: Rafael Castro L. CINVESTAV-México. (6 hrs./week)

. Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

• "Studies of algorithms to improve the transient behavior of adaptive systems". FONDECYT 1950502 project.

. Duration: 2 years, 1995 and 1996.

. Funding Source: National Fund for Scientific and Technological Development, FONDECYT.

. Allocated Funds: CLP 19,096,000

. Responsible Researcher: Manuel Duarte M. (12 hrs./week)

. Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

• "Voltage stability and reactive power deficit in the central interconnected system." FONDECYT Project 1950563.

. Duration: 2 years, 1995 and 1996.

. Funding Source: National Fund for Scientific and Technological Development, FONDECYT.

. Allocated Funds: CLP 17,611,000

. Responsible Researcher: Luis Vargas D. (10 hrs./week)

. Collaborator: Manuel Duarte M. (4 hrs./sem)

. Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

• "Automation in mineral processing". FONDEF MI-17 project. Joint project with the Departments of Electrical and Chemical Engineering of the P.U. Católica, the Department of Chemical Processes of the U.T.F. Santa María, the Department of Mining

Engineering of U. De Chile, and with the participation of SONDA and CODELCO Chile, El Teniente Division and Andina Division.

- . Duration: 3 years, May 1993 to April 1996.
- . Funding Source: Fund for the Promotion of Scientific and Technological Development, FONDEF.
- . Allocated Funds: CLP 163,305,000
- . Managing Director: Guillermo González R.
- . Alternate Director: Aldo Cipriano Z.
- . Responsible of Subprojects: Manuel Duarte M. (12 hrs./week) Marcelo Guarini H., Aldo Casali, Juan Yianatos, Aldo Cipriano, J. Ricardo Pérez, Guillermo González.
- . Other Participants: Researchers and Research Assistants of the University of Chile, P. Universidad Católica and U.T.F. Santa Maria together with engineers of the companies SONDA and CODELCO.

• “Adaptive control employing multi-controller schemes and applications”. FONDECYT Project 1930797.

- . Duration: 2 years, 1993 and 1994.
- . Funding Source: National Fund for Scientific and Technological Development, FONDECYT.
- . Allocated Funds: CLP 17,329,000
- . Responsible Researcher: Manuel Duarte M. (12 hrs./week)
- . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

• “Virtual Sensors”. FONDECYT Project 1930885.

- . Duration: 2 years, 1993 and 1994
- . Funding Source: National Fund for Scientific and Technological Development, FONDECYT
- . Allocated Funds: CLP 19,881,000
- . Responsible Researcher: Guillermo González R. (10 hrs./week)
- . Co-Researchers: Manuel Duarte M. (3 hrs./week)
- . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

• “Study and applications of robust adaptive control strategies for industrial purposes”. FONDECYT 1199/91 project.

- . Duration: 2 years, 1991 and 1992
- . Funding Source: National Fund for Scientific and Technological Development, FONDECYT
- . Allocated Funds: CLP 13,712,000
- . Responsible Researcher: Manuel Duarte M. (12 hrs./week)
- . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

• “Research and applications of robust adaptive control to plants with variable parameters”. Project DTII-3096.

- . Duration: 2 years, 1991 and 1992
- . Funding Source: Technical Research Department, University of Chile.
- . Allocated Funds: CLP 1,708,575
- . Responsible Researcher: Manuel A. Duarte M. (12 hrs./week)
- . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

• “Replacement of sensors in automatic control and instrumentation systems through the use of adaptive modeling”. FONDECYT 1254/91 project.

- . Duration: 2 years, 1991 and 1992
- . Funding Source: National Fund for Scientific and Technological Development, FONDECYT
- . Allocated Funds: CLP 14,763,000
- . Responsible Researcher: Guillermo González R. (12 hrs./week)
- . Inv. Alternate: Manuel Duarte M. (10 hrs./week).
- . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.

• “Experimental Implementation of Advanced Control Strategies for a Flotation plant”. Project 1130/89. Joint project with the Department of Electrical Engineering of the P.U. Católica and with the support of CODELCO Chile, El Teniente Division.

- . Duration: 2 years, 1989 and 1990.
- . Funding Source: National Fund for Science and Technology FONDECYT.
- . Allocated Funds: CLP 15,399,000



- . Principal Investigator: Guillermo González R. (15 hrs./week)
  - . Alternate Researcher: Manuel Duarte M. (15 hrs./week)
  - . Other Participants: Research Assistants from the University of Chile and P. Universidad Católica.
- “Adaptive Control and Identification of Systems”.
    - . Duration: 3 years, 1985-86, 1986-87, 1987-88.
    - . Funding Source: NSF (National Science Foundation).
    - . Principal Investigator: Kumpati S. Narendra.
    - . Participation: Research Assistant; June 1985- December 1988, full time.
    - . Other participants: Ph.D students of Electrical Engineering Dept. from Yale University, USA.
- “Identification of Flexible Spatial Structures”.
    - . Duration: 1 year, 1984-85.
    - . Funding Source: NASA (National Aeronautics Space Administration).
    - . Principal Investigator: Kumpati S. Narendra.
    - . Participation: Research Assistant, September 1984-May 1985, with 10 hrs./week
    - . Other participants: Master and Ph.D students of Electrical Engineering Dept. from Yale University, USA.
- “Research and Development in the Modern Control of Plants with Applications to Extractive Metallurgy”. Projects I-1951-8413, I-1951-8523 and I-1951-8633.
    - . Duration: 3 years, 1984 - 1986.
    - . Funding Source: Department of Research and Libraries, General Academic Department, University of Chile.
    - . Allocated Funds: CLP 1,700,145.
    - . Principal Investigator: Guillermo González R. (12 hrs./week)
    - . Co-Researcher: Manuel Duarte M. (12 hrs./week)
    - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.
- “Research to Improve the Profit of a Grinding Plant that is Under Classic Automatic Control”. Project FNCT 587/82 and CODELCO 782.
    - . Duration: 1 year; 1983
    - . Funding Source: National Fund for Scientific and Technological Development and CODELCO-CHILE, El Salvador Division.
    - . Allocated Funds: CLP 590,700
    - . Principal Investigator: Guillermo González R. (8 hrs./week)
    - . Co-Researchers: Manuel Duarte M. (8 hrs./week)
    - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.
- “Optimal Control of Systems with Uncertainty in the Model and Signals”. Project I-1447-8212 and I-1447-8322.
    - . Duration: 2 years; 1982 and 1983.
    - . Funding Source: Department of Research Development, General Academic Directorate, University of Chile.
    - . Allocated Funds: CLP 681,985
    - . Principal Investigator: Guillermo González R. (12 hrs./week)
    - . Co-Researcher: Manuel Duarte M. (12 hrs./week)
    - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile.
- “Optimal Control in Disturbed Systems with Application to Extractive Metallurgy and Paper Plants”. Project I-935-8012 and I-935-8122.
    - . Duration: 2 years; 1980 and 1981.
    - . Funding Source: Scientific, Artistic and International Cooperation Development Service Vice-rectory for Academic Affairs. University of Chile.
    - . Allocated Funds: CLP 562,500
    - . Principal Investigator: Guillermo González R. (12 hrs./week)
    - . Co-Researcher: Manuel Duarte M. (12hrs./week)
    - . Other Participants: Research Assistants of the Department of Electrical Engineering of the University of Chile

Exchange rate Table from CLP to USD for the last years

<b>Year</b>	<b>CLP/USD Avg. Rate</b>
2014	0.001654
2015	0.001535
2016	0.001482
2017	0.001541
2018	0.001562
2019	0.001428
2020	0.001249

## LECTURES

Course	Position	Dates
Advanced Control Systems (EL-650) In Spanish.	Lecturer	Mar.1990-Jul.1997
Adaptive Control Systems (EM-725 or EL7017) In Spanish.	Lecturer	Aug.1989- up to now
Systems and Control I (EE 336a) E.E. Department, Yale University.	Teaching Assistant	Sep.1988-Dec.1988
Adaptive Control (EE 920b) E.E. Department, Yale University.	Teaching Assistant Teaching Assistant	Jan.1988-May.1988 Jan.1987-May.1987
Control of Flexible Space Structures (EE 696b) E.E. Department, Yale University.	Teaching Assistant	Jan.1986-May.1986
Linear Systems (Control I) (EE 902a) E.E. Department, Yale University.	Teaching Assistant	Sep.1985-Dec.1985
Nonlinear Control Systems (EL-640 or EM-716) In Spanish.	Lecturer	Aug.1981-Dec.1983 Aug.1998-Dec.1999
Design Seminar (SD-20A) In Spanish.	Lecturer	Mar.2000-Jul.2000
Optimal Control Syuytems (EM-711) In Spanish.	Lecturer	Aug.2000-Dec.2000
Seminar of Automatic Control (EM- 712, AU-70C) In Spanish.	Lecturer Lecturer	Aug.1999-Dec.1999 Aug.2001-Dec.2001
Automatic Control Laboratory (EM- 715) In Spanish.	Lecturer	Aug.1999-Dec.2002
Systems Identification for Control Systems (EL-651 or EM- 717) In Spanish.	Assistant Lecturer Lecturer	Aug.1982-Dec.1983 Mar.1991-Jul.12000
Analysis and Modeling of Dynamic Systems (EL-302 or EL-32Dor EL4003) In Spanish	Teaching Assistant Assistant Lecturer Lecturer Assistant Lecturer Lecturer <sup>1</sup> Lecturer <sup>3</sup> Lecturer Lecturer <sup>2</sup> Lecturer	Mar.1975-Jul.1976 Aug.1976-Dec.1979 Mar.1980-Dec.1982 Mar.1983-Jul.1984 Mar.1984-Jul.1984 Aug.1988-Dec.1988 Mar.1989-Jul.1990 Aug.1990-Dec.1990 Mar.1991-up to now
Control Systems (EL-305or EL 42D) In Spanish.	Teaching Assistant Assistant Lecturer <sup>2</sup> Lecturer <sup>1</sup> Lecturer Lecturer <sup>3</sup>	Mar.1974-Dec.1974 Aug.1980-Dec.1980 Aug.1980-Dec.1981 Mar.1983-Jul.2000 Mar.1996-Jul 1997
Project Workshop on Control II (EL-515) In Spanish.	Lecturer <sup>1</sup>	Aug.1983-Dec.1983
Electric Power Systems (EL-403) In Spanish.	Teaching Assistant Assistant Lecturer Lecturer <sup>1</sup>	Aug.1977-Dec.1979 Mar.1980-Jul.1982 Mar.1981-Jul.1981
Electromagnetic Fields (EL-327) In Spanish.	Teaching Assistant	Mar.1975-Dec.1977
Electricity and Electronics (EL-408) In Spanish.	Teaching Assistant	Mar.1975-Jul.1977

<sup>1</sup>Shared position; 1/3 time. <sup>2</sup>Shared position; 1/2 time. <sup>3</sup>Shared position; 1/4 time

All the Lectures at the Department of Electrical Engineering of the University of Chile, except where indicated.

October, 2022