



Messaoud AMAIRI

Curriculum Vitae

*PhD, Assistant Professor
University of Gabes, Tunisia*

Teaching activities

My teaching experience covers 11 years of teaching as a research scientist (2005-2006), Contractual Assistant (2006-2010), Permanent Assistant (2010-2011) and Assistant Professor (2011-?). I taught all levels of higher education. My service was carried out in the Higher Institute of Industrial Systems Gabes (ISSIG) and the National Engineering School of Gabes (ENIG). The areas taught include: Automatic , electronics and industrial computing. I was able to give theoretical lectures and other more practical.

- Lectures 682 hours
- Tutorials 775 hours
- Practical Work 930 hours

Research activities

Research interests

My research interests focus on the use of fractional order differentiation in identification and robust control and the development of set-membership methods for the control of uncertain systems. In this context, my research work deals with:

- Modeling, simulation, identification and control systems for the fractional order differentiation.
- Set-membership methods for modelling, identification, control, diagnosis and prognosis.

Ph.D. Thesis

Title Non-integer order systems and identification by set-membership methods

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Abstract The thesis is dedicated to the development and the application of set-membership methods for parameter estimation for fractional order systems. First, a comparison between different approximations of the fractional differentiation operators is given. A new simulation method based on the numerical approximation of Diethelm is presented. Next, a new numerical method for solving a Fractional Differential Equation (FDE) based on generalized Taylor's formula and validated methods for FDEs are developed. Finally, the parameter estimation of models described by fractional order transfer functions is presented using global optimization techniques and set inversion by interval analysis.

Speciality **Electrical Engineering.**
National Engineering School of Gabes (Tunisia)

Supervisor **M. Mohamed Naceur Abdelkrim**, *Professor*, National Engineering School of Gabes, Research unit MACS.

Supervision of theses and Masters

- Theses defended**
- **Bchira SAIDI**, *On the design and implementation of fractional PID controllers for control of uncertain systems*, 24 December 2015, .
 - **Zeineb YAAKOUB**, *Identification of linear fractional closed-loop systems: Application to Control*, 24 December 2015.
- Theses in progress**
- **Amina BEN HMED**, *Time and frequency analyzes of elementary fractional order systems , application to control*, 2012-2015, Progression : 100%.
 - **Besma YOUSFI**, *On observation and diagnosis of uncertain systems*, 2012-2015, Progression : 100%.
 - **Rihab LAMOUCI**, *Fault-tolerant control for uncertain systems: set-membership approach*, 2013-2017, Progression : 70%.
 - **Saifeddine HAMD**, *Contributions to the set-membership identification of fractional systems*, 2013-2016, Progression : 50%.
 - **Mohamed Lazhar WARDI**, *Contributions to the design and implementation of robust fractional controller*, 2014-2017, Progression : 25%.
- Master**
- **Warda SALEM**, *Design and implementation of robust fractional order controller*, 2015, Research Master in Automatic and Robotic Systems (ISSIG).
Defended on November, 17 2015
 - **Naziha ARAARI**, *Design of robust fractional PID controllers based on multi-objective optimization*, 2014, Research Master in Automatic and Signal Processing (ENIT).
Defended on October, 17 2014 in National Engineering School of Tunis (Tunisia)
 - **Amina BEN HMED**, *Design and comparative study of fractional PI controller and CRONE*, 2012, Research Master in Automatic and Intelligent Techniques (ENIG).
Defended on December, 04 2012 in National Engineering School of Gabes (Tunisia)
 - **Bchira SAIDI**, *Robust design of fractional PID controller for delay systems*, 2012, Research Master in Automatic and Intelligent Techniques (ENIG).
Defended on December, 04 2012 in National Engineering School of Gabes (Tunisia)

Scientific reputation

- International cooperation
- Scholarship for High Level Scientific Stay (SSHN), France ,2015
 - Participation in ERANETMED program with Italian, Algerian, Spanish and French research teams.
 - Participation in PHC Utique 2016 program with a project untitled ' Set-membership method for FTC (MeCoToF) with collaboration of Cnam, Paris.
- Participation in the board of examiners
- **Besma YOUSFI**, *Contribution to the design of a polynomial control strategy to path following of nonlinear systems*, 2012, Research Master in Automatic and Intelligent Techniques (ENIG).
Defended on December, 12 2012 in National Engineering School of Gabes (Tunisia)
 - **Marwa SAIHI**, *Fault detection in wireless sensor networks*, 2012, Research Master in Automatic and Intelligent Techniques (ENIG).
Defended on December, 11 2012 in National Engineering School of Gabes (Tunisia)
 - **Ghazi BEL HAJ FREJ**, *Diagnosability of discrete event systems*, 2012, Research Master in Automatic and Intelligent Techniques (ENIG).
Defended on December, 01 2012 in National Engineering School of Gabes (Tunisia)
 - **Nizar RAFAA**, *Development of a polynomial approach to stabilizing control based on the method of Zubov*, 2012, Research Master in Automatic and Intelligent Techniques (ENIG).
Defended on June, 24 2012 in National Engineering School of Gabes (Tunisia)
- Participation in organizing committees
- General chair of IEEE Tunisian forum for Academia-Industry partnership (IEEE TFIAP'16) tfiap.ieee.tn, Sousse, April 01-03, 2016
 - Organization of a special session 'Fractional Calculus and its Applications', in the 3rd IEEE Conference on Control, Decision and Information Technologies CoDIT'16.
 - Spring School of Automatic Control, "On the identification, observation and diagnosis of nonlinear , hybrid and delays systems", Djerba, 20-22 March 2015
 - Conference on "Emerging Sensors and Applications", National Engineering School of Gabes, University of Gabes (Tunisia), Nov. 12 2014
 - Seminar Automation & Industry SAI'06, Matmata, Feb. 10-12, 2006
- Chair or co-chair at international conferences
- Co-chair of the session 'Robust Control', IEEE Multi-Conference on Systems and Control (MSC 2014).
- Reviewing for international journals
- Applied Mathematical Modelling (1) ; Nonlinear Dynamics (3) ; Circuits, Systems & Signal Processing (5) ; Asian Journal of Control (3), International Journal Of Modelling, Identification And Control (1).
- Reviewing for international conferences
- ACC'16; CDC'15; SafeProcess'15; MSC'14 ; STA'14.

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Participation in scientific events

- 21-23 Dec. 14 The 15th International conference on Sciences and Techniques of Automatic control & computer engineering, STA'2014, Hammamet, Tunisie
- 18-21 Mars 13 The 10th International Multi-Conference on Systems, Signals & Devices, SSD'2013, Hammamet, Tunisie
- 20-23 Mars 12 The 9th International Multi-Conference on Systems, Signals & Devices, SSD'2012, Chemnitz, Allemagne
- 20-22 Dec. 11 The 12th International conference on Sciences and Techniques of Automatic control & computer engineering, STA'2011, Tunisie
- 22-25 Mars. 11 The Eighth International Multi-Conference on Systems, Signals & Devices, SSD'2011, Hammamet, Tunisie
- 5-7 Nov. 10 La Commande et l'Observation des Systèmes à Structure Variables, École d'Automne d'Automatique EAA'10
- 23 Janv. 10 Journée Internationale de la Recherche pour l'Innovation Technologique et la Création Industrielle RITCI'2010
- 14-16 Dec. 09 Etudes Énergétiques des Systèmes : Diagnostic, Evaluation, Modélisation et Optimisation EES DEMO'09
- 20-22 Dec. 09 10th International conference on Sciences and Techniques of Automatic control & computer engineering
- 22-25 Mars. 09 École de Printemps de Maths pour la Recherche et le Développement
- 13-15 Dec. 08 École d'Hiver de Bond Graphs
- 16-19 Mars. 08 École de Printemps de Diagnostic à Base de modèles
- 23 Dec. 07 École d'Hiver de Maths pour la Recherche et le Développement
- 19 Mai 07 Débats sur les synergies Industrie-Université
- 06-08 Nov. 06 École d'Automne d'Automatique EAA'06
- 10-12 Fev. 06 Séminaire d'Automatique-Industrie SAI'06

Publications

Publications in international journals

Published **13 papers.**

- 13 **M. Amairi**, *Recursive set membership estimation for output-error fractional models with unknown-but-bounded errors*, International Journal of Applied Mathematics and Computer Science, Vol. 26, No. 3., 2016. (**I.F 1.003**)
- 12 B. Yousfi, T. Raissi, **M. Amairi**, D. Gucik-Derigny and M. Aoun, *Robust state estimation for singularly perturbed systems*, International Journal of Control, 2016. (**I.F 1.88**)
- 11 A. Ben Hmed, **M. Amairi**, and M. Aoun, *Robust stabilization and control using fractional order integrator*, Transactions of the Institute of Measurement and Control, 2016 (**I.F 0.82**)

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- 10 Z. Yakoub , M. Chetoui, **M. Amairi** and M. Aoun, *A bias correction method for fractional closed-loop system identification.* , Journal of Process Control, Volume 33, Pages 25–36, 2015 (**I.F 2.216**)
- 9 **M. Amairi**, *Recursive set-membership parameter estimation using fractional model.* , Circuits, Systems & Signal Processing. Volume 34, Issue 12, pp 3757-3788, 2015(**I.F 1.178**)
- 8 Z. Yakoub, **M. Amairi**, M. Chetoui and M. Aoun, *On the closed-loop system identification with fractional models.* , Circuits, Systems & Signal Processing. Volume 34, Issue 12, pp 3833-3860, 2015 (**I.F 1.178**)
- 7 B. Saidi, **M. Amairi**, S. Najjar and M. Aoun, *Bode shaping-based design methods of a fractional order PID controller for uncertain systems.*, Nonlinear Dynamics. Volume 80, Issue 4, pp 1817-1838 , 2015(**I.F 3.0**)
- 6 A. Ben Hmed, **M. Amairi**, and M. Aoun, *Stability and resonance conditions of the non-commensurate elementary fractional transfer functions of the second kind*, Communications in Nonlinear Science and Numerical Simulation. Volume 22, Issues 1-3, Pages 842-865, 2015. (**I.F 2.834**)
- 5 **M. Amairi**, S. Najjar, M. Aoun, Z. Lassoued and M.N. Abdelkrim, *OBE-based set-membership parameter estimation of fractional models*, Transactions on Systems, Signals & Devices, Issues on Systems, Analysis & Automatic Control, Vol. 9, No. 1, pp.39-58, 2014 (**indexé INSPEC**)
- 4 M. Aoun, **M. Amairi**, S. Najjar, and M.N. Abdelkrim, *New simulation method for fractional systems based on the Caputo fractional differentiation*, Transactions on Systems, Signals & Devices, Issues on Systems, Analysis & Automatic Control, Vol. 8, No. 1, pp.41-62, 2013 (**indexé INSPEC**)
- 3 **M. Amairi**, M. Aoun, S. Najjar, and M.N. Abdelkrim, *Guaranteed frequency-domain identification of fractional order systems: application to a real system*, Int. J. Modelling, Identification and Control, Vol. 17, No. 1, pp.32-42, 2012 (**indexé Scopus**)
- 2 **M. Amairi**, M. Aoun, S. Najjar, M. N. Abdelkrim , *A constant enclosure method for validating existence and uniqueness of the solution of an initial value problem for a fractional differential equation*, Applied Mathematics and Computation, vol.217 n° 5,pp.2162–2168, 2010 (**I.F 1.536**)
- 1 **M. Amairi**, M. Aoun, S. Najjar, M. N. Abdelkrim, *New method for the resolution of fractional orders differential equations: application to the simulation of fractional systems*, International Review on Modeling and Simulation , vol.3 n° 3 June 2010, 2010 (**indexé Scopus**)

Papers presented in international conferences

International
conferences **27 papers.**

- 27 M. L. Wardi, **M. Amairi** and M. N. Abdelkrim, *Robust fractional order PI Controller design for Nonlinear Systems via Singular Perturbations Technique*, International Conference on Fractional Differentiation and its Applications, Novi Sad, Serbia, July 18 - 20, 2016.
- 26 S. Hamdi, **M. Amairi** and M. Aoun, *Orthotopic Set-Membership Parameter Estimation of Fractional Order Model*, 24th Mediterranean Conference on Control and Automation, Athens, Greece, June 21-24, 2016.

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- 25 R. Lamouchi, **M. Amairi**, T. Raissi and M. Aoun, *Interval Observer Design for Linear Parameter-Varying Systems Subject to Component Faults*, 24th Mediterranean Conference on Control and Automation, Athens, Greece, June 21-24, 2016.
- 24 R. Lamouchi, T. Raissi, **M. Amairi** and M. Aoun, *Fault Tolerant Control in a Set-Membership Framework*, 15th European Control Conference (ECC), 2016.
- 23 M. L. Wardi, **M. Amairi** and M. N. Abdelkrim, *Robust fractional control of a two time scale system*, 16th International conference on Sciences and Techniques of Automatic control & computer engineering, 2015.
- 22 B. Yousfi, T. Raissi, **M. Amairi** and M. Aoun, *Set Membership Methodology for model-based systems prognosis*, 9th IFAC Symposium on Fault Detection, Supervision and Safety for Technical Processes, Safeprocess'15, 48 (21), 302-307, 2015.
- 21 B. Saidi, **M. Amairi**, S. Najar and M. Aoun, *Multi-objective optimization based design of fractional PID controller*, The 12th International Multi-Conference on Systems, Signals & Devices, SSD'2015, 2015.
- 20 Z. Yakoub, M. Chetoui, **M. Amairi** and M. Aoun, *A direct fractional order bias eliminated least squares method for the fractional closed-loop system identification*, The 12th International Multi-Conference on Systems, Signals & Devices, SSD'2015, 2015.
- 19 A. Ben Hmed, **M. Amairi** and M. Aoun, *Stabilizing fractional order controller design for first and second order systems*, The 12th International Multi-Conference on Systems, Signals & Devices, SSD'2015, 2015.
- 18 A. Ben Hmed, **M. Amairi**, S. Najar, and M. Aoun, *Fractional order controller design using time-domain specifications*, 15th International conference on Sciences and Techniques of Automatic control & computer engineering - STA'2014, pp. 462-467, Hammamet, Tunisia, 2014
- 17 B. Saidi, **M. Amairi**, S. Najar, and M. Aoun, *Fractional PI design for time delay systems based on min-max optimization*, 15th International conference on Sciences and Techniques of Automatic control & computer engineering - STA'2014, pp. 468-473, Hammamet, Tunisia, 2014
- 16 B. Yousfi, T. Raissi, **M. Amairi** and M. Aoun, *Interval Observers Design for Singularly Perturbed Systems*, in the 53rd IEEE Conference on Decision and Control (CDC-14), 2014
- 15 **M. Amairi**, M. Aoun and B. Saidi, *Design of robust fractional order PI for FOPDT systems via set inversion*, IEEE Conference on Control Applications (CCA), 8-10 Oct. 2014, pp. 1166 - 1171, <http://dx.doi.org/10.1109/CCA.2014.6981486>, 2014
- 14 Z. Yakoub, **M. Amairi**, M. Chetoui, and M. Aoun, *A bias-eliminated least squares method for continuous-time fractional closed-loop system identification*, IEEE Conference on Control Applications (CCA), 8-10 Oct. 2014, pp. 128-133, <http://dx.doi.org/10.1109/CCA.2014.6981340>, 2014
- 13 B. Saidi, **M. Amairi**, S. Najar, and M. Aoun, *Fractional PI design for time delay systems based on min-max optimization*, IEEE Conference on Fractional Differentiation and Its Applications (ICFDA), 23-25 June. 2014, pp. 1-6, <http://dx.doi.org/10.1109/ICFDA.2014.6967440>, 2014

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- 12 A. Ben Hmed, **M. Amairi**, S. Najar, and M. Aoun , *Resonance study of an elementary fractional transfer function of the third kind*, IEEE Conference on Fractional Differentiation and Its Applications (ICFDA), 23-25 June. 2014, pp. 1-6, <http://dx.doi.org/10.1109/ICFDA.2014.6967437>, 2014
- 11 Z. Yakoub, M. Chetoui, **M. Amairi** and M. Aoun, , *Indirect approach for closed-loop system identification with fractional models*, IEEE Conference on Fractional Differentiation and Its Applications (ICFDA), 23-25 June. 2014, pp. 1-6, <http://dx.doi.org/10.1109/ICFDA.2014.6967441>, 2014
- 10 B. Saidi, S. Najar, **M. Amairi**, M. N. Abdelkrim , *Design of a robust fractional PID controller for a second order plus dead time system*, 10th International Multi-Conference on Systems, Signals and Devices (SSD'13), Tunis, Tunisia, 2013
- 9 A. Ben Hmed, **M. Amairi**, S. Najar, M. N. Abdelkrim , *Design of fractional PI controller with guaranteed time and frequency-domain performances*, 10th International Multi-Conference on Systems, Signals and Devices (SSD'13), Tunis, Tunisia, 2013
- 8 S. E. Hamdi, **M. Amairi**, M. Aoun, M. N. Abdelkrim , *Interval state observer design for fractional systems*, 10th International Multi-Conference on Systems, Signals and Devices (SSD'13), Tunis, Tunisia, 2013
- 7 A. Guefrachi, S. Najar, **M. Amairi**, M. Aoun, M. N. Abdelkrim , *Frequency response of a fractional complex order transfer function*, 13th International conference on Sciences and Techniques of Automatic control & computer engineering, pp. 765-773, Academic Publication Center of Tunis, Tunisia, 2012
- 6 **M. Amairi**, M. Aoun, S. Najar, M. N. Abdelkrim , *Set membership parameter estimation of linear fractional systems using parallelotopes*, The Ninth International Multi-Conference on Systems, Signals & Devices (SSD), 2012
- 5 M. Aoun, **M. Amairi**, S. Najar, M. N. Abdelkrim , *Simulation method of fractional systems based on the discrete-time approximation of the Caputo fractional derivative*, The Eighth International Multi-Conference on Systems, Signals & Devices (SSD), 2011
- 4 M. Aoun, **M. Amairi**, Z. Lassoued, S. Najar, M. N. Abdelkrim , *An ellipsoidal set-membership parameter estimation of fractional order systems*, The Eighth International Multi-Conference on Systems, Signals & Devices (SSD), 2011
- 3 **M. Amairi**, S. Najar, M. Aoun, M. N. Abdelkrim , *Guaranteed output-error identification of fractional order model*, The 2nd IEEE International Conference on Advanced Computer Control(ICACC 2010), pp. 246-250, IEEE Press, 2010
- 2 **M. Amairi**, M. Aoun, S. Najar, M. N. Abdelkrim , *Interval analysis approach for frequency domain identification of a non integer order electronic system*, 10th International conference on Sciences and Techniques of Automatic control & computer engineering, pp. 1122-1133 Academic Publication Center of Tunis, Tunisia, 2009
- 1 **M. Amairi**, M. Aoun, S. Najar, M. N. Abdelkrim , *Bounded error parameter estimation using fractionnel models*, Cinquième Conférence internationale JTEA, 2008

National conferences **3 papers.**

- 3 B. Saidi, S. Najjar, **M. Amairi**, M. N. Abdelkrim , *Design and digital implementation of a fractional PID controller*, 4ème Colloque de Recherche Appliquée et de Transfert de Technologie, CRATT'2012, Tunis, Tunisia, 2012
- 2 A. Ben Hmed, **M. Amairi**, S. Najjar, M. N. Abdelkrim , *Analog and pseudo-analog implementation of fractional PID controller*, 4ème Colloque de Recherche Appliquée et de Transfert de Technologie, CRATT'2012, Tunis, Tunisia, 2012
- 1 **M. Amairi**, M. Aoun, S. Najjar, M. N. Abdelkrim , *Estimation paramétrique d'un système fractionnaire par une approche ensembliste*, Huitièmes journées scientifiques des jeunes chercheurs en génie électrique et informatique GEI'2008, 2008