INFORMAŢII PERSONALE

BUŞONIU Ion-Lucian

📍 Str. Dorobanţilor 71-73, Cluj-Napoca, Romania

📞 +40 (0)264 40 1586

✉ lucian@busoniu.net

🌐 http://busoniu.net

Sexul M | Data naşterii 09/12/1979 | Naţionalitatea Română

Oct. 2018 – prezent	**Profesor universitar**
	Departamentul de Automatică, UTCluj, România
	activitate didactică şi de cercetare
	Tipul sau sectorul de activitate învăţământ superior şi cercetare
Oct. 2014 – Sept. 2018	**Conferenţiar universitar**
	Departamentul de Automatică, UTCluj, România
	activitate didactică şi de cercetare
	Tipul sau sectorul de activitate învăţământ superior şi cercetare
Oct. 2011 – Sept. 2014	**Şef lucrări**
	Departamentul de Automatică, UTCluj, România
	activitate didactică şi de cercetare
	Tipul sau sectorul de activitate învăţământ superior şi cercetare
Ian. 2012 – Sept. 2013	**Cercetător (pentru cooperare ştiinţifică de la UTCluj)**
	CNRS, Centre de Recherche en Automatique de Nancy, France.
	cercetare pe subiectul Planificarea şi optimizarea pentru control.
	Tipul sau sectorul de activitate cercetare
Apr. 2011 – dec. 2011	**Postdoc (pentru cooperare ştiinţifică de la UTCluj)**
	echipa SequeL, INRIA Lille-Nord Europe, Franţa
	cercetare pe subiectul Planificarea şi învăţarea online.
	Tipul sau sectorul de activitate cercetare
Ian. 2009 – mar. 2011	**Postdoc**
	Delft Center for Systems and Control (DCSC), Delft University of Technology (TUDelft), Olanda
	cercetare pe subiectul Învăţarea prin recompensă
	Tipul sau sectorul de activitate cercetare
Oct. 2003 – ian. 2005	**Asistent în regim plata cu ora**
	Departamentul de Automatică, UTCluj, România
	activitate didactică şi de cercetare
	Tipul sau sectorul de activitate învăţământ superior şi cercetare

EXPERIENTA PROFESSIONALA ▬▬▬▬▬▬▬▬▬▬▬▬▬ ◼

EDUCAŢIE ŞI FORMARE ▬▬▬▬▬▬▬▬▬▬▬▬▬ ◼

Dec. 2015	**Abilitare în domeniul ingineria sistemelor**
	Universitatea Tehnică din Cluj-Napoca
	Teza: Optimistic planning for nonlinear optimal control and networked systems
Ian. 2009	**Doctorat *cum laude* (singura distincţie acordată în Olanda)**
	Delft Center for Systems and Control (DCSC), Delft University of Technology (TUDelft), Olanda
	Teza: Reinforcement Learning in Continuous State and Action Spaces
Mai 2007	**Absolvent al cursurilor Dutch Institute for Systems and Control.**
	Dutch Institute for Systems and Control, Olanda

- Systems and control theory of nonlinear systems
- Model-predictive control,
- Mathematical models of systems
- Design methods for control systems
- System identification for control
- Control and system theory of stochastic systems

Octombrie 2003 – Iunie 2004	**Studii aprofundate "Tehnici moderne în controlul automat"**
	Universitatea Tehnică din Cluj-Napoca
	Dizertaţia: *MicroJava Agents in Testing*
Octombrie 1998 – Iunie 2003	**Diplomă de inginer, specializarea Automatică şi Informatică Aplicată**
	Universitatea Tehnică din Cluj-Napoca
	Dizertaţia: *Multi-Agent Systems in Distributed Built-In Self-Testing and Distributed Testing*

Limba(i) maternă(e)	Română

Alte limbi străine cunoscute

	INTELEGERE		VORBIRE		SCRIERE
	Ascultare	Citire	Participare la conversaţie	Discurs oral	
Engleză	C2	C2	C2	C2	C2
	Cetrificat de competenţă lingvistică, Universitatea Tehnică din Delft				
Franceză	B1	B2	B1	B1	B1

Niveluri: A1/2: Utilizator elementar - B1/2: Utilizator independent - C1/2: Utilizator experimentat
Cadrul european comun de referinţă pentru limbi străine

Competenţe de comunicare	- Competenţe de comunicare obţinute în participarea şi conducerea de proiecte şi colaborări de cercetare.
Competenţe organizaţionale/manageriale	- Competenţe de management pentru conducerea de grupuri şi proiecte de cercetare. Responsabil pentru o echipă de 8 persoane (Robotică şi Control Neliniar), şi pentru patru proiecte de cercetare cu echipe.

COMPETENTE PERSONALE

Competenţe informatice	- Progamarea, profesional si ca hobby: cunostinte avansate de MATLAB, Java, C/C++, programare în limbaje web client şi server (HTML, CSS, JavaScript, PHP)

INFORMATII SUPLIMENTARE

Publicaţii	Autor al cărţii *Reinforcement Learning and Dynamic Programming Using Function Approximators*, Taylor & Francis CRC Press, 2010; al 22 articole de jurnal ISI de top, 7 capitole de carte, o carte editată, şi peste 50 de articole la conferinţe internaţionale recenzate. În total, peste 4500 de citări şi h-index de 22 în Google Scholar.
Proiecte	6 proiecte câştigate prin competiţie în calitatea de director de proiect (două Tinere Echipe, 1 bilateral, 1 AUF-RO). Un Horizon 2020 RIA câştigat ca responsabil de partener. Membru în echipa pentru un proiect internaţional şi 3 proiecte naţionale
Distincţii	*Cum laude*, cea mai mare distincţie acordată în Olanda, pentru susţinerea tezei de doctorat (2009). Premiul Andrew P. Sage 2009 pentru cel mai bun articol în IEEE Transactions on Systems, Man and Cybernetics, primit pentru articolul *"A Comprehensive Survey of Multi-Agent Reinforcement Learning"*, care este în top 1% al celor mai citate articole ISI. Şef al promoţiei de Automatică (120+ studenţi), UTCluj, România, 2003. Premii multiple PRECISI pentru publicarea în reviste de top ISI, inclusiv un top 1 revistă în categorie.
Organizator şi recenzor la reviste şi conferinţe	L. Buşoniu a fost cochair al 2014, 2015 IEEE Symposium on Adaptive Dynamic Programming and Reinforcement Learning, Orlando, Florida, US, şi a coorganizat mai multe workshopuri, track-uri, şi sesiuni speciale la conferinţe internaţionale majore. Este de asemenea implicat în activităţi de recenzie pentru majoritatea revistelor şi conferinţelor de top din automatică şi învăţarea automată; a ţinut peste 10 prezentări invitate internaţionale; a organizat vizite ale unor cercetători străini şi a fost la rândul lui invitat pentru vizite; cooperează cu cercetători din ţări de pe mai multe continente etc.
Coordonare studenţi	Director al 3 proiecte de doctorat, cosupervizor al altor 4, al 9 masteranzi (2 dintre care au absolvit *cum laude* în Olanda), şi peste 15 studenţi la licenţă.
Afilieri	IEEE, Control Systems Society Membru invitat în IEEE Technical Committee on Adaptive Dynamic Programming and Reinforcement Learning, şi în IFAC TC on Computational Intelligence in Control.

Ataşate:
- **CV în format academic**
- **Listă de publicaţii**

Curriculum vitae

Lucian Buşoniu, 40 years old, full professor and group lead, Web: http://busoniu.net

Google Scholar: https://scholar.google.com/citations?user=INMQGAIAAAAJ

BrainMap: https://www.brainmap.ro/public-profile-82880451 (ID U-1700-039F-9024)

Major degrees

- Oct. 2015: **habilitation** (independent PhD advising), Technical Univ. of Cluj-Napoca, Romania.

- Jan. 2009: **PhD**, Delft University of Technology, the Netherlands, obtained *cum laude (highest distinction in the Netherlands).*

- Jun. 2003: **MSc** *(valedictorian among 120+ students)* in Control, TUCluj, Romania.

Professional experience since PhD, highlighting leadership positions.

- Mar. 2020 – now: **Cofounder** Robotics.AI startup, www.robotics-ai.org/ (*leadership position*)

- Oct.2011 **Assistant-**, Oct.2014 **Associate-**, Oct.2018 **Full Professor**, Automation Dept., TUCluj *Leadership opportunities*: Since 2013, I lead the ROCON research group (http://rocon.utcluj.ro, 6 permanent staff + many students). In multiple funded grants, I led as PI teams of 4 to 11 people.

- Jan. 2012 – Sept. 2013: **Research scientist CNRS**, Research Center for Automatic Control of Nancy (CRAN), France. Tenured position obtained via *competitive contest with ~5% success rate*.

- Apr. 2011 – Dec. 2011: **Postdoctoral fellow**, Team SequeL, INRIA Lille-Nord Europe, France.

- Jan. 2009 – Mar. 2011: **Postdoctoral fellow**, TUDelft, the Netherlands.

Publications, scientometric indicators and highlights

- Author of **more than 80 scientific publications**, including: 25 journal papers (out of which 21 ISI, most in the Q1 "red zone"), 48 international conference papers with proceedings and peer review, 7 book chapters, 1 authored monograph book (Taylor & Francis), 1 edited book (Springer).

- Scientific impact: **h-index 14 with 1618 citations in ISI Web of Knowledge** (ISI)**,** h-index 22 with 4157 citations in Google Scholar (GS).

- My first ever journal paper, *A Comprehensive Survey of Multi-Agent Reinforcement Learning*, in IEEE Trans. Systems, Man & Cybernetics C, received the 2009 **Andrew Sage best paper award**, and the **Highly Cited Paper award - top 1% ISI cited papers**. 562 ISI / 1291 GS citations.

- My monograph *Reinforcement Learning and Dynamic Programming Using Function Approximators*, published in 2010 with Taylor & Francis CRC Press, has become a **major reference** in the field, with 383 ISI / 863 GS citations.

For more distinctions and recognition, as well as funded projects and leadership, see Section B3.2.

Selected invited scientific visits (at least week-long, since PhD)

- Sept 2019, NorthEastern University, Shenyang, China.

- Multiple visits as **invited professor** to LAMIH, University of Valenciennes, France.

- Multiple visits to University of Lorraine, France.

- Apr–May 2014: Microsoft Research Center New England, Boston, US.

Organization of scientific events

- Open invited tracks: Reinforcement Learning and Nonlinear Optimal Control, IFAC Congress 2020 (online/Berlin), and Reinforcement Learning for Control, IFAC Congress 2017 (Toulouse).
- **Co-chair** of the 2015 (Cape Town) and 2014 (Orlando) editions of IEEE Symposium on Adaptive Dynamic Programming & Reinforcement Learning (ADPRL).
- Special sessions at CDC 2016 (Las Vegas), IEEE ADPRL 2013 (Singapore) and 2011 (Paris).

Academic service, commissions of trust

- Associate Editor for ISI Q1 journal Engineering Applications of Artificial Intelligence; for the IFAC World Congress (largest event in control), and for IROS (top robotics conference); invited member of the IEEE TC on ADPRL and the IFAC TC on Computational Intelligence in Control.
- Review committees for PhD theses (UPC Spain, TUDelft), foreign grant proposals (FWO & SBO Belgium, NWO Netherlands, EPSRC UK, Croatian Centers of Excellence, NSERC Canada, ANR France), selection committees for postdoc and faculty positions up to full professor, etc.
- Reviewer for Springer, Elsevier, and most leading journals and conferences in AI and control.
- Made available Matlab toolboxes for learning and planning, see http://busoniu.net/repository.php

Advised and co-advised PhD projects

- 2019-ongoing, I. Lal, *Nonlinear control design for a ball balancing robot*, TUCluj, Romania.
- 2017-ongoing, Z. Nagy, *Optimal Sensing for Control*, TUCluj, Romania.
- 2017-ongoing, D. Mezei, *Active Sensing in Robotics*, TUCluj, Romania.
- 2016-2019, G. Feng, *Reinforcement Learning for Assistive Wheelchairs*, U. Valenciennes, France.
- 2016-2019, M. Granzotto, *Stability Analysis of Optimal Control*, U. Lorraine, France
- 2013-2016, K. Mathe, *Nonlinear Control of UAVs in Autonomous Inspection*, TUCluj, Romania.
- 2010-2015, I. Grondman, *Online Actor-Critic Control*, TUDelft, the Netherlands.

Key academic collaborations

- Starting 2019: prof. Sorin Grigorescu, Univ. Transylvania of Brasov, Romania.
- Starting 2018: dr. Ivana Palunko, dr. Domagoj Tolic, University of Dubrovnik, Croatia.
- Starting 2014: Prof.dr. Dragan Nešić, University of Melbourne, Australia.
- Starting 2012: Prof.dr. J. Daafouz, Dr. R. Postoyan, Prof.dr. C. Morărescu, U. Lorraine, France.
- Starting 2009: Senior Researcher Dr. Rémi Munos, Google DeepMind and INRIA Lille, France.
- Starting 2009: Prof.dr. Bart De Schutter, Prof.dr. Robert Babuška, TUDelft, the Netherlands.
- 2006 – 2011: Prof.dr. Damien Ernst, University of Liege, Belgium. B3.2. The autonomy and visibility of the scientific activity

Research projects as Principal Investigator or coordinator (funded by competition; selection)

I have competitively obtained funding of around **1 million EUR** for my institution as PI:

- 2020 – 2023: Institution PI and proposal lead for **Horizon 2020 Research & Innovation** project *SeaClear: SEarch, identificAtion and Collection of marine Litter with Autonomous Robots*, 5 MEUR total budget, 555 000 EUR TUCluj budget. http://seaclear-project.eu/

- 2018 – ongoing: PI for UEFISCDI **Young Teams** project *AIRGUIDE: A Learning Aerial Guide for the Elderly and Disabled*. Employs 5 people, 100 000 EUR. Led to 6 journal + 10 conference articles. http://airguide.busoniu.net/

- 2013 – 2016: **Young Teams** project *Reinforcement Learning and Planning for Large-Scale Systems*, Romania. 180 000 EUR, employed 4 people. Led to 5 journals, 14 conferences, 1 book + 1 chapter. http://yt.busoniu.net.

- 2016 – 2017: PI for AUF international cooperation project *AI methods for the networked control of assistive UAVs*. Team of 11 people, 33 000 EUR. http://rocon.utcluj.ro/node/196

- 2015 – 2016: Romanian-side PI for PHC bilateral international project, *Artificial-Intelligence-Based Optimization for the Stable and Optimal Control of Networked Systems*. 3000 EUR. Led to 3 journals, 1 conference, and 1 chapter. http://rocon.utcluj.ro/node/77

- 2015 – 2017: Romanian-side PI for PICS bilateral international project *Optimisation fondee sur l'intelligence artificielle pour le controle des systemes en reseau et hybrides*, funded by France.

I am also institution PI in an ongoing Erasmus+ KA2 project (32 000 EUR institution budget), where I lead 5 people; and have obtained multiple internal grants totaling ~3500EUR. SMART will import management expertise and scientific results from all these projects. We emphasize SeaClear in particular, which will produce different mapping techniques based on active learning, and focusing only on the litter problem.

Leadership and capacity to manage scientific activities:

- In 2013 I **established** and since then I am **leading the ROCON research group** (Robotics and Nonlinear Control, http://rocon.utcluj.ro, 6 permanent staff and several students).

- In funded grants, since 2013 until today I have **led as PI teams of 4 to 11 people**, see §B3.2a.

- In 2020 I have **cofounded** the AI startup Robotics.AI www.robotics-ai.org, on computer vision and deep learning techniques.

- **Lead or coorganizer** of two IEEE Symposia and multiple invited and open sessions, see §B2e.

- **Advisor** of 3 ongoing PhD projects (+ 3 more expected to start starting autumn 2020); and coadvisor of 4 successfully completed PhD projects, see §B2g.

Awards and distinctions

- 2009 **Andrew P. Sage award** for best paper in IEEE Trans. Systems, Man and Cybernetics Part C, for *A Comprehensive Survey of Multi-Agent Reinforcement Learning*.

- **Highly Cited Paper award - top 1% cited papers - in ISI**, for the same paper.

- **Cum laude**, highest distinction in the Netherlands, for the PhD thesis and defense (January 2009).

- Received 8 times the **PRECISI award** for publishing in high-impact journals; one of these for the **top 1 journal** in category Measurement & Instrumentation – IEEE Trans. on Industrial Electronics.

- Sept 2019: week-long course on planning and RL, Northeastern University, Shenyang, China.

- Mar 2019: winter course on RL, Dutch Institute of Systems and Control, Delft, the Netherlands.

- Nov 2018: *Optimistic planning in MDPs*, **keynote** at Asian Workshop on Machine Learning; *Planning for optimal control*; Chinese Academy of Sciences, both in Beijing, China.

- Jul 2018: *Basics of RL*, Transylvanian Machine Learning **Summer School**, Cluj, Romania.

- Jun 2018: *AI planning for nonlinear optimal control*, **keynote** at IFAC CESCIT, Faro, Portugal.

- Oct 2017: *Online, Optimistic Planning for Markov Decision Processes*, ACAI **Summer School** on RL, Nieuwpoort, Belgium.

- Jun 2017: *Approximate dynamic programming & RL for control*, MSc course, U.Valencia, Spain.

- Jul 2016: *Planning Methods for Near-Optimal Continuous Control*, City University UK, London.

- Oct 2015: *Reinforcement Learning and Planning Algorithms*, invited at workshop on Machine Learning in Planning and Control of Robot Motion, within IROS conference, Hamburg, Germany.

- Sept 2014: *Nonlinear Near-Optimal Control Using Optimistic Planning*, Italian Institute of Technology, Genova, Italy.

- Dec 2013: *Optimistic Planning for General Nonlinear Near-Optimal Control*, invited at workshop on Intelligent Planning and Control, IEEE Conference on Decision and Control, Florence, Italy.

- Dec. 2011: *Reinforcement Learning with Function Approximation*, invited at workshop on Optimal Adaptive Control, IEEE Conference on Decision and Control, Orlando, US.

- Sept. 2010: *Efficient Reinforcement Learning for Control*, University of Liege, Belgium.

International doctoral committees

In addition to my own coadvised international PhD students, for which I was of course on the committee (2 in France and 1 in the Netherlands) – see §B2g, I was invited on the committees of:

- Jun 2019: Jia Xu, Delft University of Technology, the Netherlands.

- Apr 2016: Subramanya Nageshrao, Delft University of Technology, the Netherlands.

In 2014, I was a thesis reviewer for Gennaro Esposito, Universitat Politecnica de Catalunya, Spain.

Editorial board

- **Associate Editor** for ISI Q1 journal Engineering Applications of Artificial Intelligence. Relative influence score 1.966 (the minimum required is 0.5). See also §B2f.

A final note: my total Relative Influence Scores for main-author papers published between 2012 and 2020 is 30.084 (more than **10 times larger** than the eligibility limit).

Books

- L. Busoniu, L. Tamas (editors), **Handling Uncertainty and Networked Structure in Robot Control**, Springer, Series *Studies in Systems, Decision and Control*. February 2016, ISBN 978-3-319-26327-4. »
- L. Busoniu, R. Babuska, B. De Schutter, D. Ernst, **Reinforcement Learning and Dynamic Programming Using Function Approximators**, CRC Press, Series *Automation and Control Engineering*. April 2010, 280 pages, ISBN 978-1439821084. »

Journal papers

- L. Busoniu, V. Varma, J. Loheac, A. Codrean, O. Stefan, C. Morarescu, S. Lasaulce, **Learning control for transmission and navigation with a mobile robot under unknown communication rates**. *Control Engineering Practice*, vol. 100, 2020. In press. »
- D. Mezei, L. Tamas, L. Busoniu, **Sorting Objects from a Conveyor Belt Using POMDPs with Multiple-Object Observations and Information-Gain Rewards**. *Sensors*, vol. 20, no. 9, 2020. »
- M. Granzotto, R. Postoyan, L. Busoniu, D. Nesic, J. Daafouz, **Finite-horizon discounted optimal control: stability and performance**. *IEEE Transactions on Automatic Control*, vol. 37, 2020. In press. »
- C. Morarescu, V. Varma, L. Busoniu, S. Lasaulce, **Space-time budget allocation policy design for viral marketing**. *Nonlinear Analysis - Hybrid Systems*, vol. 37, 2020. In press. »
- L. Busoniu, J. Ben Rejeb, I. Lal, I.-C. Morarescu, J. Daafouz, **Optimistic minimax search for noncooperative switched control with or without dwell time**. *Automatica*, vol. 112, 2020. »
- G. Feng, L. Busoniu, T.M. Guerra, S. Mohammad, **Data-Efficient Reinforcement Learning for Energy Optimization of Power-Assisted Wheelchairs**. *IEEE Transactions on Industrial Electronics*, vol. 66, no. 12, pages 97340–9744, 2019. »
- L. Busoniu, T. de Bruin, D. Tolic, J. Kober, I. Palunko, **Reinforcement Learning for Control: Performance, Stability, and Deep Approximators**. *Annual Reviews in Control*, vol. 46, pages 8–28, 2018. »
- L. Busoniu, E.Pall, R. Munos, **Continuous-action planning for discounted infinite-horizon nonlinear optimal control with Lipschitz values**. *Automatica*, vol. 92, pages 100–108, 2018. »
- K. Mathe, L. Busoniu, R. Munos, B. De Schutter, **Optimistic planning with an adaptive number of action switches for near-optimal nonlinear control**. *Engineering Applications of Artificial Intelligence*, vol. 67, 2018. »
- R. Postoyan, L. Busoniu, D. Nesic, J. Daafouz, **Stability Analysis of Discrete-Time Infinite-Horizon Optimal Control with Discounted Cost**. *IEEE Transactions on Automatic Control*, vol. 62, no. 6, pages 2736–2749, 2017. »
- L. Busoniu, J. Daafouz, M.-C. Bragagnolo, C. Morarescu, **Planning for optimal control and performance certification in nonlinear systems with controlled or uncontrolled switches**. *Automatica*, vol. 78, pages 297–308, 2017. »
- L. Busoniu, A. Daniels, R. Babuska, **Online Learning for Optimistic Planning**. *Engineering Applications of Artificial Intelligence*, vol. 55, pages 60–72, 2016. »

- L. Busoniu, R. Postoyan, J. Daafouz, **Near-optimal Strategies for Nonlinear and Uncertain Networked Control Systems**. *IEEE Transactions on Automatic Control*, vol. 61, no. 8, pages 2124–2139, 2016. [»](#)
- K. Mathe, L. Busoniu, **Vision and Control for UAVs: A Survey of General Methods and of Inexpensive Platforms for Infrastructure Inspection**. *Sensors*, vol. 15, no. 7, pages 14887–14916, 2015. [»](#)
- L. Busoniu, C. Morarescu, **Topology-Preserving Flocking of Nonlinear Agents Using Optimistic Planning**. *Control Theory and Technology*, vol. 13, no. 1, pages 70–81, 2015. [»](#)
- L. Busoniu, C. Morarescu, **Consensus for Black-Box Nonlinear Agents Using Optimistic Optimization**. *Automatica*, vol. 50, no. 4, pages 1201–1208, 2014. [»](#)
- I. Grondman, L. Busoniu, G. Lopes, R. Babuska, **A Survey of Actor-Critic Reinforcement Learning: Standard and Natural Policy Gradients**. *IEEE Transactions on Systems, Man, and Cybernetics—Part C: Applications and Reviews*, vol. 42, no. 6, pages 1291–1307, 2012. [»](#)
- I. Grondman, M. Vaandrager, L. Busoniu, R. Babuska, E. Schuitema, **Efficient Model Learning Methods for Actor-Critic Control**. *IEEE Transactions on Systems, Man, and Cybernetics—Part B: Cybernetics*, vol. 42, no. 3, pages 591–602, 2012. [»](#)
- S. Adam, L. Busoniu, R. Babuska, **Experience Replay for Real-Time Reinforcement Learning Control**. *IEEE Transactions on Systems, Man, and Cybernetics—Part C: Applications and Reviews*, vol. 42, no. 2, pages 201–212, 2012. [»](#)
- L. Busoniu, D. Ernst, B. De Schutter, R. Babuska, **Cross-Entropy Optimization of Control Policies with Adaptive Basis Functions**. *IEEE Transactions on Systems, Man, and Cybernetics—Part B: Cybernetics*, vol. 41, no. 1, pages 196–209, 2011. [»](#)
- L. Busoniu, D. Ernst, B. De Schutter, R. Babuska, **Approximate Dynamic Programming with a Fuzzy Parametrization**. *Automatica*, vol. 46, no. 5, pages 804–814, 2010. [»](#)
- L. Busoniu, R. Babuska, B. De Schutter, **A Comprehensive Survey of Multi-Agent Reinforcement Learning**. *IEEE Transactions on Systems, Man, and Cybernetics — Part C: Applications and Reviews*, vol. 38, no. 2, pages 156–172, 2008. *Recipient of the 2009 Andrew P. Sage Award for the best paper published annually in the IEEE Transactions on Systems, Man and Cybernetics.* [»](#)

Contributions to books

- E. Pall, L. Tamas, L. Busoniu, **Vision-Based Quadcopter Navigation in Structured Environments**. In *Handling Uncertainty and Structure in Robot Control*, L. Busoniu, L. Tamas, Editors, pages 265–290. Springer, 2016. [»](#)
- M. Bragagnolo, C. Morarescu, L. Busoniu, P. Riedinger, **Decentralized Formation Control in Fleets of Nonholonomic Robots with a Clustered Pattern**. In *Handling Uncertainty and Structure in Robot Control*, L. Busoniu, L. Tamas, Editors, pages 313–333. Springer, 2016. [»](#)
- L. Busoniu, R. Munos, R. Babuska, **A Review of Optimistic Planning in Markov Decision Processes**. In *Reinforcement Learning and Adaptive Dynamic Programming for Feedback Control*, F. Lewis, D. Liu, Editors, series *Computational Intelligence*, pages 494–516. Wiley, 2012. [»](#)
- L. Busoniu, A. Lazaric, M. Ghavamzadeh, R. Munos, R. Babuska, B. De Schutter, **Least-Squares Methods for Policy Iteration**. In *Reinforcement Learning: State of*

the Art, M. Wiering, M. van Otterlo, Editors, series *Adaptation, Learning, and Optimization*, no. 12, pages 75–109. Springer, 2012. [»](#)

- L. Busoniu, R. Babuska, B. De Schutter, **Multi-Agent Reinforcement Learning: An Overview**. In *Innovations in Multi-Agent Systems and Applications*, D. Srinivasan, L. Jain, Editors, series *Studies in Computational Intelligence*, no. 310, pages 183–221. Springer, 2010. [»](#)
- L. Busoniu, B. De Schutter, R. Babuska, **Approximate Dynamic Programming and Reinforcement Learning**. In *Interactive Collaborative Information Systems*, R. Babuska, F.C.A. Groen, Editors, series *Studies in Computational Intelligence*, no. 281, pages 3–44. Springer, 2010. [»](#)
- L. Busoniu, D. Ernst, B. De Schutter, R. Babuska, **Continuous-State Reinforcement Learning with Fuzzy Approximation**. In *Adaptive Agents and Multi-Agent Systems III*, K. Tuyls, A. Nowe, Z. Guessoum, D. Kudenko, Editors, series *Lecture Notes in Computer Science (Lecture Notes in Artificial Intelligence)*, vol. 4865, pages 27–43. Springer, 2008. [»](#)

Conference papers

- I. Lal, A. Codrean, L. Busoniu, **Sliding mode control of a ball balancing robot**. Accepted at *21st IFAC World Congress (IFAC-20)*, Online (Berlin, Germany), 12–17 July 2020. [»](#)
- Csanad Sandor, Szabolcs Pavel, Wieser Erik, Andreea Blaga, Peter Boda, Andrea-Orsolya Fulop, Adrian Ursache, Attila Zold, Aniko Kopacz, Botond Lazar, Karoly Szabo, Zoltan Tasnadi, Botond Trinfa, Lehel Csato, Dan Marius Tegzes, Marian Leontin Pop, Raluca Alexandra Tarziu, Mihai-Valentin Zaha, Sorin Mihai Grigorescu, Lucian Busoniu, Paula Raica, Levente Tamas, **The ClujUAV student competition: A corridor navigation challenge with autonomous drones**. Accepted at *21st IFAC World Congress (IFAC-20)*, Online (Berlin, Germany), 12–17 July 2020. [»](#)
- K. Mirkamali, L. Busoniu, **Cross Entropy Optimization of Action Modification Policies for Continuous-Valued MDPs**. Accepted at *21st IFAC World Congress (IFAC-20)*, Online (Berlin, Germany), 12–17 July 2020. [»](#)
- Z. Nagy, Zs. Lendek, L. Busoniu, **Control and Estimation for Mobile Sensor-Target Problems with Distance-Dependent Noise**. Accepted at *IEEE American Control Conference (ACC-20)*, Online (Denver, Colorado), 1–3 July 2020.
- R. Postoyan, M. Granzotto, L. Busoniu, B. Scherrer, D. Nesic, J. Daafouz, **Stability guarantees for nonlinear discrete-time systems controlled by approximate value iteration**. Accepted at *58th IEEE Conference on Decision and Control (CDC-19)*, Nice, France, 11–13 December 2019. [»](#)
- M. Granzotto, R. Postoyan, L. Busoniu, D. Nesic, J. Daafouz, **Optimistic planning for the near-optimal control of nonlinear switched discrete-time systems with stability guarantees**. Accepted at *58th IEEE Conference on Decision and Control (CDC-19)*, Nice, France, 11–13 December 2019. [»](#)
- L. Busoniu, J. Daafouz, C. Morarescu, **Near-optimal control of nonlinear systems with simultaneous controlled and random switches**. In *5th IFAC Conference on Intelligent Control and Automation Sciences (ICONS-19)*, pages 268–273, Belfast, Northern Ireland, 21–23 August 2019. [»](#)
- G. Feng, T.M. Guerra, A.T. Nguyen, L. Busoniu, S. Mohammad, **Robust Observer-Based Tracking Control Design for Power-Assisted Wheelchairs**. In *5th IFAC*

Conference on Intelligent Control and Automation Sciences (ICONS-19), pages 61–66, Belfast, Northern Ireland, 21–23 August 2019. [»](#)

- A.-D. Mezei, L. Tamas, L. Busoniu, **Sorting objects from a conveyor belt using active perception with a POMDP model**. In *18th IEEE European Control Conference (ECC-19)*, pages 2466–2471, Napoli, Italy, 25–28 June 2019. [»](#)
- I. Lal, M. Nicoara, A. Codrean, L. Busoniu, **Hardware and Control Design of a Ball Balancing Robot**. In *22nd IEEE International Symposium on Design and Diagnostics of Electronic Circuits & Systems (DDECS-19)*, Cluj-Napoca, Romania, 24–26 April 2019. [»](#)
- M. Granzotto, R. Postoyan, L. Busoniu, D. Nesic, J. Daafouz, **Stability analysis of discrete-time finite-horizon discounted optimal control**. In *57th IEEE Conference on Decision and Control (CDC-18)*, pages 2322–2327, Miami, USA, 17–19 December 2018. [»](#)
- C. Morarescu, V. Varma, L. Busoniu, S. Lasaulce, **Space-time budget allocation for marketing over social networks**. In *Proceedings IFAC Conference on Analysis and Design of Hybrid Systems (ADHS-18)*, pages 211–216, Oxford, UK, 11–13 July 2018. [»](#)
- L. Busoniu, V. S. Varma, I.-C. Morarescu, S. Lasaulce, **Learning-based control for a communicating mobile robot under unknown rates**. In *IEEE American Control Conference (ACC-19)*, pages 267–272, Philadelphia, USA, 10–12 July 2019. [»](#)
- G. Feng, L. Busoniu, T.M. Guerra, S. Mohammad, **Reinforcement Learning for Energy Optimization Under Human Fatigue Constraints of Power-Assisted Wheelchairs**. In *IEEE American Control Conference (ACC-18)*, Milwaukee, USA, 27–29 June 2018. [»](#)
- C. Iuga, P. Dragan, L. Busoniu, **Fall monitoring and detection for at-risk persons using a UAV**. In *IFAC Conference on Embedded Systems, Computational Intelligence and Telematics in Control (CESCIT-18)*, Faro, Portugal, 6–8 June 2018. [»](#)
- G. Feng, T.M. Guerra, S. Mohammad, L. Busoniu, **Observer-Based Assistive Control Design Under Time-Varying Sampling for Power-Assisted Wheelchairs**. In *IFAC Conference on Embedded Systems, Computational Intelligence and Telematics in Control (CESCIT-18)*, Faro, Portugal, 6–8 June 2018. [»](#)
- G. Feng, T.M. Guerra, L. Busoniu, S. Mohammad, **Unknown input observer in descriptor form via LMIs for power-assisted wheelchairs**. In *36th Chinese Control Conference (CCC-17)*, Dalian, China, 26–28 July 2017. [»](#)
- J. Xu, L. Busoniu, B. De Schutter, **Near-Optimal Control with Adaptive Receding Horizon for Discrete-Time Piecewise Affine Systems**. In *Proceedings 20th IFAC World Congress (IFAC-17)*, pages 4168–4173, Toulouse, France, 9–14 July 2017. [»](#)
- J. Ben Rejeb, L. Busoniu, I.-C. Morarescu, J. Daafouz, **Near-Optimal Control of Nonlinear Switched Systems with Non-Cooperative Switching Rules**. In *IEEE American Control Conference (ACC-17)*, Seattle, USA, 24–26 May 2017. [»](#)
- S. Sabau, I.-C. Morarescu, L. Busoniu, A. Jadbabaie, **Decoupled-Dynamics Distributed Control for Strings of Nonlinear Autonomous Agents**. In *IEEE American Control Conference (ACC-17)*, Seattle, USA, 24–26 May 2017. [»](#)
- E. Pall, L. Tamas, L. Busoniu, **Analysis and a Home Assistance Application of Online AEMS2 Planning**. In *Proceedings IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS-16)*, Daejeon, Korea, 9–14 October 2016. [»](#)
- J. Xu, T. van den Boom, L. Busoniu, B. De Schutter, **Model Predictive Control for Continuous Piecewise Affine Systems Using Optimistic Optimization**. In *Proceedings IEEE American Control Conference (ACC-16)*, Boston, USA, 6–8 July 2016. [»](#)

- L. Busoniu, E. Pall, R. Munos, **Discounted Near-Optimal Control of General Continuous-Action Nonlinear Systems Using Optimistic Planning**. In *Proceedings IEEE American Control Conference (ACC-16)*, Boston, USA, 6–8 July 2016. »
- K. Mathe, L. Busoniu, L. Barabas, L. Miclea, J. Braband, C. Iuga, **Vision-Based Control of a Quadrotor for an Object Inspection Scenario**. In *Proceedings 2016 International Conference on Unmanned Aircraft Systems (ICUAS-16)*, pages 849–857, Arlington, USA, 7–10 June 2016. »
- J. Xu, L. Busoniu, T. van den Boom, B. De Schutter, **Receding-Horizon Control for Max-Plus Linear Systems with Discrete Actions Using Optimistic Planning**. In *Proceedings 13th International Workshop on Discrete Event Systems (WODES-16)*, pages 398–403, Xi'an, China, 30 May – 1 June 2016. »
- L. Busoniu, M.-C. Bragagnolo, J. Daafouz, C. Morarescu, **Planning Methods for the Optimal Control and Performance Certification of General Nonlinear Switched Systems**. In *Proceedings 54th IEEE Conference on Decision and Control (CDC-15)*, Osaka, Japan, 15–18 December 2015. »
- T. Wensveen, L. Busoniu, R. Babuska, **Real-Time Optimistic Planning with Action Sequences**. In *Proceedings 20th International Conference on Control Systems and Computer Science (CSCS-15)*, pages 923–930, Bucharest, Romania, 27–29 May 2015. »
- R. Postoyan, L. Busoniu, D. Nesic, J. Daafouz, **Stability of Infinite-Horizon Optimal Control with Discounted Cost**. In *Proceedings 53rd IEEE Conference on Decision and Control (CDC-14)*, pages 3903–3908, Los Angeles, USA, 15–17 December 2014. »
- K. Mathe, L. Busoniu, R. Munos, B. De Schutter, **Optimistic Planning with a Limited Number of Action Switches for Near-Optimal Nonlinear Control**. In *Proceedings 53rd IEEE Conference on Decision and Control (CDC-14)*, pages 3518–3523, Los Angeles, USA, 15–17 December 2014. »
- L. Busoniu, R. Munos, Elod Pall, **An Analysis of Optimistic, Best-First Search for Minimax Sequential Decision Making**. In *Proceedings IEEE Symposium on Adaptive Dynamic Programming and Reinforcement Learning (ADPRL-14)*, pages 1–8, Orlando, USA, 10–13 December 2014. »
- L. Busoniu, L. Tamas, **Optimistic Planning for the Near-Optimal Control of General Nonlinear Systems with Continuous Transition Distributions**. In *Proceedings 19th IFAC World Congress (IFAC-14)*, pages 1910–1915, Cape Town, South Africa, 24–29 August 2014. »
- K. Mathe, L. Busoniu, L. Miclea, **Optimistic Planning with Long Sequences of Identical Actions for Near-Optimal Nonlinear Control**. In *Proceedings 2014 IEEE International Conference on Automation, Quality and Testing, Robotics (AQTR-14)*, Cluj-Napoca, Romania, 22–24 May 2014. »
- E. Pall, K. Mathe, L. Tamas, L. Busoniu, **Railway Track Following with the AR.Drone Using Vanishing Point Detection**. In *Proceedings 2014 IEEE International Conference on Automation, Quality and Testing, Robotics (AQTR-14)*, Cluj-Napoca, Romania, 22–24 May 2014. »
- L. Busoniu, C. Morarescu, **Consensus for Agents with General Dynamics Using Optimistic Optimization**. In *Proceedings 2013 Conference on Decision and Control (CDC-13)*, Florence, Italy, 10–13 December 2013. »
- L. Busoniu, R. Postoyan, J. Daafouz, **Near-Optimal Strategies for Nonlinear Networked Control Systems Using Optimistic Planning**. In *Proceedings 2013 American Control Conference (ACC-13)*, Washington DC, US, 17–19 June 2013. »

- L. Busoniu, C. Morarescu, **Optimistic Planning for Consensus**. In *Proceedings 2013 American Control Conference (ACC-13)*, Washington DC, US, 17–19 June 2013. **»**
- R. Fonteneau, L. Busoniu, R. Munos, **Optimistic Planning for Belief-Augmented Markov Decision Processes**. In *Proceedings 2013 Symposium on Adaptive Dynamic Programming and Reinforcement Learning (ADPRL-13)*, Singapore, 15–19 April 2013. **»**
- L. Busoniu, A. Daniels, R. Munos, R. Babuska, **Optimistic Planning for Continuous-Action Deterministic Systems**. In *Proceedings 2013 Symposium on Adaptive Dynamic Programming and Reinforcement Learning (ADPRL-13)*, Singapore, 15–19 April 2013. **»**
- I. Grondman, L. Busoniu, R. Babuska, **Model-Learning Actor-Critic Algorithms: Performance Evaluation in a Motion Control Task**. In *Proceedings 51st IEEE Conference on Decision and Control (CDC-12)*, pages 5272–5277, Maui, Hawaii, 10–13 December 2012. **»**
- M. Vaandrager, R. Babuska, L. Busoniu, G. Lopes, **Imitation Learning with Non-Parametric Regression**. In *Proceedings 2012 IEEE International Conference on Automation, Quality and Testing, Robotics (AQTR-12)*, pages 91–96, Cluj-Napoca, Romania, 24–27 May 2012. **»**
- L. Busoniu, R. Munos, **Optimistic Planning for Markov Decision Processes**. In *Proceedings 15th International Conference on Artificial Intelligence and Statistics (AISTATS-12)*, pages 182–189, La Palma, Canary Islands, Spain, 21–23 April 2012. **»**
- S. Norrouzadeh, L. Busoniu, R. Babuska, **Efficient Knowledge Transfer in Shaping Reinforcement Learning**. In *Proceedings 18th IFAC World Congress (IFAC-11)*, Milano, Italy, 22 August–2 September 2011. **»**
- I. Grondman, M. Vaandrager, L. Busoniu, R. Babuska, E. Schuitema, **Actor-Critic Control with Reference Model Learning**. In *Proceedings 18th IFAC World Congress (IFAC-11)*, pages 14723–14728, Milano, Italy, 22 August–2 September 2011. **»**
- L. Busoniu, D. Ernst, B. De Schutter, R. Babuska, **Approximate Reinforcement Learning: An Overview**. In *Proceedings 2011 IEEE International Symposium on Adaptive Dynamic Programming and Reinforcement Learning (ADPRL-11)*, pages 1–8, Paris, France, 11–15 April 2011. **»**
- L. Busoniu, R. Munos, B. De Schutter, R. Babuska, **Optimistic Planning for Sparsely Stochastic Systems**. In *Proceedings 2011 IEEE International Symposium on Adaptive Dynamic Programming and Reinforcement Learning (ADPRL-11)*, pages 48–55, Paris, France, 11–15 April 2011. Part of the Special Session on *Active Reinforcement Learning*. **»**
- E. Schuitema, L. Busoniu, R. Babuska, P. Jonker, **Control Delay in Reinforcement Learning for Real-Time Dynamic Systems: A Memoryless Approach**. In *Proceedings 2010 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS-10)*, pages 3226–3231, Taipei, Taiwan, 18–22 October 2010. **»**
- L. Busoniu, D. Ernst, B. De Schutter, R. Babuska, **Online Least-Squares Policy Iteration for Reinforcement Learning Control**. In *Proceedings 2010 American Control Conference (ACC-10)*, pages 486–491, Baltimore, United States, 30 June – 2 July 2010. **»**
- L. Busoniu, B. De Schutter, R. Babuska, D. Ernst, **Using Prior Knowledge to Accelerate Online Least-Squares Policy Iteration**. In *Proceedings 2010 IEEE International Conference on Automation, Quality and Testing, Robotics (AQTR-10)*, Cluj-Napoca, Romania, 28–30 May 2010. **»**

- L. Busoniu, D. Ernst, B. De Schutter, R. Babuska, **[Policy Search with Cross-Entropy Optimization of Basis Functions](#)**. In *Proceedings 2009 IEEE International Symposium on Adaptive Dynamic Programming and Reinforcement Learning (ADPRL-09)*, pages 153–160, Nashville, United States, 30 March – 2 April 2009. [»](#)
- X. Yuan, L. Busoniu, R. Babuska, **[Reinforcement Learning for Elevator Control](#)**. In *Proceedings 17th IFAC World Congress (IFAC-08)*, pages 2212–2217, Seoul, Korea, 6–11 July 2008. [»](#)
- L. Busoniu, D. Ernst, B. De Schutter, R. Babuska, **[Fuzzy Partition Optimization for Approximate Fuzzy Q-iteration](#)**. In *Proceedings 17th IFAC World Congress (IFAC-08)*, pages 5629–5634, Seoul, Korea, 6–11 July 2008. [»](#)
- L. Busoniu, D. Ernst, R. Babuska, B. De Schutter, **[Consistency of Fuzzy Model-Based Reinforcement Learning](#)**. In *Proceedings 2008 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE-08)*, pages 518–524, Hong Kong, 1–6 June 2008. [»](#)
- L. Busoniu, D. Ernst, R. Babuska, B. De Schutter, **[Fuzzy Approximation for Convergent Model-Based Reinforcement Learning](#)**. In *2007 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE-07)*, pages 968–973, London, United Kingdom, 23–26 July 2007. [»](#)
- L. Busoniu, D. Ernst, R. Babuska, B. De Schutter, **Continuous-State Reinforcement Learning with Fuzzy Approximation**. In *Adaptive Learning Agents and Multi-Agent Systems (ALAMAS-07) Symposium*, pages 21–35, Maastricht, The Netherlands, 2–3 April 2007. [»](#)
- L. Busoniu, B. De Schutter, R. Babuska, **[Decentralized Reinforcement Learning Control of a Robotic Manipulator](#)**. In *Proceedings 9th IEEE International Conference on Control, Automation, Robotics and Vision (ICARCV-06)*, pages 1347–1352, Singapore, 5–8 December 2006. [»](#)
- L. Busoniu, R. Babuska, B. De Schutter, **Multi-Agent Reinforcement Learning: A Survey**. In *Proceedings 9th IEEE International Conference on Control, Automation, Robotics and Vision (ICARCV-06)*, pages 527–532, Singapore, 5–8 December 2006. [»](#)
- L. Busoniu, B. De Schutter, R. Babuska, **[Multiagent Reinforcement Learning with Adaptive State Focus](#)**. In *Proceedings 17th Belgian-Dutch Conference on Artificial Intelligence (BNAIC-05)*, pages 35–42, Brussels, Belgium, 17–18 October 2005. [»](#)

Theses

- L. Busoniu, **[Optimistic Planning for Nonlinear Optimal Control and Networked Systems](#)**, habilitation thesis, 2015, 155 pages. [»](#)
- L. Busoniu, **Reinforcement Learning in Continuous State and Action Spaces**, PhD thesis, 2008, 190 pages, ISBN 978-90-9023754-1. [»](#)

National journal papers

- K. Mathe, L. Busoniu, L. Miclea, **Optimistic Planning with Long Sequences of Identical Actions: An Extended Theoretical and Experimental Study**. *Acta Electrotehnica*, vol. 56, no. 4, pages 27–34, 2015. [»](#)
- L. Busoniu, B. De Schutter, R. Babuska, D. Ernst, **Exploiting Policy Knowledge in Online Least-Squares Policy Iteration: An Empirical Study**. *Automation, Computers, Applied Mathematics*, vol. 19, no. 4, pages 521–529, 2010. [»](#)

Abstracts, workshop presentations

- L. Busoniu, A. Daniels, R. Munos, R. Babuska, **Optimistic Planning for Continuous-Action Deterministic Systems**. Presented at the *8emes Journees Francophones sur la Planification, la Decision et l'Apprentissage pour la conduite de systemes (JFPDA-13)*, Lille, France, 1–2 July 2013. [»](#)
- L. Busoniu, R. Munos, B. De Schutter, R. Babuska, **Optimistic Planning for Sparsely Stochastic Systems**. Presented at the *2011 Workshop on Monte-Carlo Tree Search: Theory and Applications, within the 21st International Conference on Automated Planning and Scheduling (ICAPS-11)*, Freiburg, Germany, 12 June 2011. [»](#)