

# **Gildas BESANÇON**

Born in April 1971, Prof., Dr, Eng.

Currently at Grenoble Institute of technology, Gipsa-lab

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## **EDUCATION & WORK EXPERIENCE**

### **Current position**

Professor Grenoble INP – Ense3 (Univ. Grenoble Alpes)

Control Systems Department, Gipsa-lab - BP 46, 38402 Saint-Martin d'Hères, France

### **Cursus and milestones**

- sept. 2010: Full professor Ense3
- sept. 2010 : National distinguished position at *Institut Universitaire de France* (honorary since 2015)
- sept. 2008 : ENSIEG joins Ense3 (Energy, water and Environmental Engineering)
- jan. 2007 : LAG joins GIPSA-lab (Grenoble Images, speech, Signal, Automatic control)
- jan. 2002 : Accreditation to supervise research ('associate prof.')
- sept. 1999 : 'Maître de Conférences' position ('assistant prof.') at ENSIEG / LAG, Grenoble
- sept. 1998 – aug. 1999 : Teaching position in Industrial Eng. (ESISAR), Valence
- may 1998 – aug. 1998 : Research Engineer CNRS, LAG, Grenoble
- jan. 1997 – april 1998 : Post-doct' position at Univ Rome 1 La Sapienza, Italy
- sept. 1993 – oct 1996 : PHD position in Control, LAG (control research dep.), Grenoble
- sept. 1990 – 1993 : Electrical engineering (at ENSIEG) & Master degree in control (at LAG), Grenoble

## **TEACHING & RESEARCH TOPICS**

***In short: Observers and control for nonlinear and complex systems, with applications to energy, water, & physics***

### **Teaching**

All aspects of control, from theory to applications

(Transfer functions, state space representations, identification, optimal control, robust control, nonlinear control, including both courses and labs)

With various charges (pedagogy, labs, studies)

### **Research**

Observers and applications – including identification, control, monitoring for nonlinear systems and/or large-scale / infinite dimensional systems with applications in hydraulics, power systems, micro/nanosciences and various charges (projects, contracts, team)

## **SCIENTIFIC ANIMATION**

***In short: head of 7 international projects, + various local or national charges***

### **International level**

- Head of a French-Venezuelan project on fluid transport systems 2011-15.
- Head of various French-Mexican projects from 2006 on (pipeline monitoring in 2009 & 2010, water transportation/treatment on 2006-08, marine risers 2014-15).
- Participant to other French-Mexican projects on water management (2004-05) and electrical systems (2004-06)
- Participant to a French-Moroccan project on electrical machines (2010-12).
- Head of a French-Italian project on output feedback control, 2002.

### **National level**

- Head of Gipsa participation to a national project on Wind Power 2011-15 (National Research Agency)
- Head of a national 'brainstorming group' on nonlinear estimation 2002 (National Sci. Res. Center CNRS)
- Participant to various national control groups since 1995.

### **Local level**

- Head of Gipsa Research team SYSCO on 'nonlinear and complex systems' 2011-20.
- Head of a workpackage in a Grenoble Cross Disciplinary Project on Risk modelling & assessment 2018-22
- Participant to a Grenoble INP/UGA project (coll Inst. Neurosciences GIN) on EEG signal analysis 2018-22
- Head of a Grenoble 'Excellence' project on estimation issues in tunnelling current and MEMS, 2016-19.
- Participant to a Grenoble INP project on risks in hydraulic engineering and hydrology, 2012-16.
- Head of a Grenoble INP project on Automatic Leak Detection in pipelines 2011-14.
- Coordinator of Gipsa control research activities in Energy, Water, Environment, 2007-09.

## INDUSTRIAL-ORIENTED ACTIVITIES

***In short: participations to more than 10 industrial projects and 3 patents***

### ***In charge of various industrial projects :***

- with EDF on hydroelectricity 2009-12, 2015-18, 2018-21; on combined cycle production 2012-15.
- with Rio Tinto Alcan on aluminium production, 2012-13, and 2018-22
- with CEA-LETI on nanochromatography 2008-09; nanocantilever 2006-07; microgyrometer 2004-06.

### ***Participations in various other industrial collaborations:***

- with ST microelectronics on converters, 2007.
- with PSA on battery monitoring, 2001.
- with Alcatel-Alsthom/ALSTOM/Areva, on control/monitoring of electrical drives, 1998-2004

### ***International and industrial patents:***

- Co-inventor of a new hybrid combined cycle, 2015.
- Co-inventor of a new submicronic positioning, 2008.
- Co-inventor of a new Atomic Force Microscope, 2006.

## INVITED EXPERT ACTIVITIES

***In short: ~15 invited international lectures + various other 'expert' activities***

### ***Invited international PHD classes and lectures in congresses:***

- Research lecture at Univ Nacional Autonoma de Mexico, « Excitación para observadores », spring 2015
- Master/PHD talk at Univ de los Andes, Merida, Venezuela, « Observación del estado », fall 2011
- Post Graduate class at Univ Libre Bruxelles « observers and FDI applications », spring 2009
- Head and lecturer of Int. Control Summer School of Grenoble “*Nonlinear observers and applications*”, fall 2007
- European PHD classes « Nonlinear observers », Paris, ENPC and SUPELEC, spring 2006 and 2005 resp.
- Mini-course at CINVESTAV, Guadalajara, ‘Automatización del transporte del agua’, spring 2006
- Labs “regulation” for Mexican Summer School at Grenoble, France, fall 2006.
- Mini-course “*Nonlinear control systems*” at Technical Univ. Brno, Czech Rep., spring 2004.
- Invited talk Control Summer School 2021 TURIX DYNAMICS for ITTG Mexico, June 2021
- Invited plenary talk in ‘22nd Int. Conf. on System Theory, Control and Computing’, Romania, 2018
- Invited conf in Workshop ‘Irrigation channels and related problems’, Italy, Oct. 2008
- Invited conf in Workshop ‘Nonlinear Control Systems’, Metz, France, Oct. 2004
- Invited conf in Workshop ‘New trends in observer design’, Geiranger, Norway, 1999
- 2 Invited conf in Workshop ‘Complex Systems’, London, UK, 1998
- Various invited lectures in academic as well as industrial contexts
- Various participations in invited sessions and chair activities in international congresses

### ***Participations to scientific committees and expertises :***

- IEEE TAC associate Editor since 2018, and TC ‘Nonlinear systems and control’ since 2016.
- IFAC TC ‘SafeProcess’ since 2003, ‘Nonlinear Systems’ since 2012. ‘Adaptive systems’ since 2014
- IPC CIFA 2008 (RO) 2010,12 (FR), ALCOSP 2013 (FR), CLCA 2014 (MX), CDPS 2015 (PL), ALCOSP 2016,19,22  
IFAC World 2017&20, Safepro 2018&21, MICNON 2018&21, NOLCOS 2019&22, IEEE ICSTCC >2018 (RO)
- NOC 2nd POSTA congress (POSitive Systems Theory and Applications), 2006, France.
- Regular evaluations of projects, PHDs/Habilitations, articles, and hiring, in control.

## SCIENTIFIC SUPERVISION

***In short: 18 achieved PHDs, 4 in progress and many other student supervisions***

### ***PHD supervision :***

PHDs in progress on ‘observers in hydroelectricity’, ‘risk monitoring from heterogeneous data’, ‘multivariable control for aluminium production’, ‘fractional order model for EEG’ // Former PHDs on ‘observers for hyperbolic systems’ (2020), ‘CBO & STM application’ (2019), ‘modeling for hydroelectricity’ (2018), ‘adjoint-based estimation for hydrology’ (2016), ‘combined cycle optimization’ (2015), ‘electromechanical nanopositioning’ (2015), ‘observability and pipeline observers’ (2015), ‘coordinated power systems’ (2014), ‘conservation laws’ (2012), ‘hydropower plants’ (2012), ‘STM-like system’ (2011), ‘models & observers for pipelines’ (2011), ‘tunneling current’ (2010), ‘control for transport-like infinite dim. systems’ (2009), ‘nonlinear estimation & power systems’ (2006), ‘ctrl of VSC-HVDC systems’ (2005), ‘geometric modeling of electrical drives’ (2004), ‘nonlinear ctrl for irrigation canals’ (2001).

### ***International PHD training supervision:***

Students from Colombia, Czech Rep., Madagascar, Mexico, Rumania + various other trainee supervisions

**In short: 1 Springer book, 18 book chapters, 65 journal papers,  
194 international congress papers**

**cf JOURNAL PAPERS from 2015 on:**

- [J1] L.F. Torres, G. Besançon, C. Verde and J.F. Guerrero-Castellanos, *Generalized synchronization of a class of spatiotemporal chaotic systems using nonlinear observers*, Int. J. Bifurcation and Chaos, vol 25, No11, 2015.
- [J2] G. Besançon and I. Munteanu, *Control strategy for state and input observer design*, Systems and Control Letters, vol.85, pp.118-122, 2015.
- [J3] L. Ryba, A. Voda and G. Besançon, *Experimental comparison of disturbance observer and inverse-based hysteresis compensation in 3D nanopositioning piezoactuation*, Sensors & actuators A. Phys., vol 236, 2015.
- [J4] J. Delgado, G. Besançon, O. Begovich, J. Carvajal, *Multi-leak diagnosis in pipelines based on Extended Kalman Filter*, Control Engineering Practice, vol 49, pp.139-148, 2016.
- [J5] V.T. Nguyen, D. Georges, G. Besançon, *State and parameter estimation in 1-D hyperbolic PDEs based on an adjoint method*, Automatica, vol.67, pp.185-191, 2016.
- [J6] A. Ticlea and G. Besançon, *Adaptive observer design for discrete-time LTV systems*, International Journal of Control, vol.89, No12, pp.2385-95, 2016.
- [J7] A. Delgado-Aguiñaga, G. Besançon, O. Begovich, *Exact-differentiation-based leak detection and isolation in a plastic pipeline under temperature variations*, Journal of Process Control, vol.42, pp.114-124, 2016.
- [J8] L. Torres, A. Delgado-Aguiñaga, G. Besançon, C. Verde, O. Begovich, *Equivalent Liénard-type models for a fluid transmission line*, Comptes Rendus – Mécanique, vol 344, No8, pp.582-95, 2016.
- [J9] J. Leo, F. Davelaar, G. Besançon and A. Voda, *Configuration and coordinated-distributed control strategy for a hybrid combined cycle*, Electric Power Systems Research, vol 140, pp.735-744, 2016.
- [J10] I. Munteanu and G. Besançon, *Identification-based prediction of wind park power generation*, Renewable Energy, Volume 97, Pages 422–433,2016.
- [J11] J. Leo, F. Davelaar, G. Besançon and A. Voda, *Moving-boundary modeling and LQ control study for a solar Linear Fresnel Reflector*, Int Journal of Modelling Identification and Control, vol.28, No1, pp.14-27, 2017.
- [J12] I. Rubio Scola, G. Besançon, D. Georges, *Blockage/leak detection and location in pipelines using frequency response optimization*, Journal of Hydraulic Engineering, vol 143, No1, 2017.
- [J13] L. Ryba J. Dokoupil A. Voda and G. Besançon, *Adaptive hysteresis compensation on an experimental nanopositioning platform*, International Journal of Control, vol 90, No4, pp.765-778, 2017.
- [J14] V.T. Nguyen, D. Georges, G. Besançon, *Calculus of variations approach for state and parameter estimation in switched 1-D hyperbolic PDEs*, Optimal Control, Applications and Methods, 2017.
- [J15] I. Rubio Scola, G. Besançon, and D. Georges, *Optimizing Kalman optimal observer for state affine systems by input Selection*, Automatica, 2018.
- [J16] JR. Bermúdez, FR. López-Estrada, G. Besançon, G. Valencia-Palomo, L. Torres and HR. Hernández, *Modeling and simulation of a hydraulic network for optimal control and leaks diagnosis*, Mathematical and Computational Applications, vol.23, No4, 2018.
- [J17] G. Besançon, A. Voda and G. Becq, *Fractional order modelling and identification for a phantom EEG system*, IEEE Transactions Control Systems Technology, 2019.
- [J18] A. Navarro Díaz, J. Delgado Aguiñaga, J. D. Sánchez Torres, O. Begovich Mendoza, and G. Besançon, *Evolutionary Observer Ensemble for Leak Diagnosis in Long Water Pipelines*, Processes, vol.7, No12, pp.913, 2019.
- [J19] N. Meslem, J. Martinez, N. Ramdani and G. Besançon, *An H-Infinity Interval Observer for Uncertain Continuous-Time Linear Systems*, International Journal of Robust and Nonlinear Control, 30 (5), pp.1886-1902, 2020.
- [J20] A. Popescu, G. Besançon, A. Voda, S. Basrour, *Observer-based 3D control enhancement for topographic imaging - Validation with an STM prototype*, IEEE Transactions Control Systems Technology, 2020.
- [J21] C. Kitsos, G. Besançon, and C. Prieur, *High-gain observer design for some semilinear reaction-diffusion systems: a transformation-based approach*, IEEE Control Systems Letters (L-CSS), 2020.
- [J22] J. Moreno and G. Besançon, *On multi-valued observers for a class of single-valued systems*, Automatica, 2021.
- [J23] V.T. Nguyen, D. Georges and G. Besançon, *Calculus of variations approach for parameters estimation in a hydrological system*, European Journal of Control, vol. 60, pp.11-19, 2021.
- [J24] C. Kitsos, G. Besançon, and C. Prieur, *High-gain observer for 3x3 linear heterodirectional hyperbolic systems*, Automatica, vol 129, 2021.
- [J25] C. Kitsos, G. Besançon, and C. Prieur, *High-Gain Observer Design for a Class of Quasi-Linear Integro-Differential Hyperbolic Systems - Application to an Epidemic Model*, IEEE Trans Automatic Control, 2021.
- [J26] C. Kitsos, E. Cerpa, G. Besançon, and C. Prieur, *Output feedback control of a cascade system of linear korteweg-de vries equations*, SIAM J. Control and Optimization, vol. 59, No 4, pp. 2955-2976, 2021.
- [J27] F. Ferrante and G. Besançon, *On Angular Speed Estimation of Rigid Bodies*, IEEE Control Systems Letters (L-CSS), vol 6, pp. 1394-1399, 2022 (to appear).