

# Roland Lenain, Research Director in mobile robotics



40 years old, Married, 3 children  
[www.irstea.fr/lenain](http://www.irstea.fr/lenain)



## Education

2011	<b>Habilitation to supervise research<sup>1</sup></b> Control of robots in uncertain dynamics, the case of mobile robots	Univ. Blaise Pascal Clermont-Ferrand, Fr
2005	<b>PhD</b> Contribution to the modelling and control of mobile robots under sliding	Univ. Blaise Pascal Clermont-Ferrand, Fr
2002	<b>Master degree, Civil and Mechanical Engineering</b>	Univ. Blaise Pascal Clermont-Ferrand, Fr
2002	<b>Mechanical Engineer diploma</b>	French Institute for Advanced Mechanics

## Current position and leadership

Since 2014	<b>Research team leader</b> Romea [Robotics and Mobility for Environment and Agriculture] 20 people	Irstea, TSCF unit. Clermont-Ferrand, Fr
Since 2013	<b>National Research group animation</b> Leader of technical group on unmanned ground vehicle, supported by CNRS	France (national mission)
Since 2016	<b>President of scientific board of national RobAgri association</b> Previously member of the executing committee before association creation, which gather 61 members (public and private), to federate and promote Agricultural robotics	France (national mission)
Since 2015	<b>Local challenge animation</b> Leader of challenge Intelligent Vehicles of a laboratory of excellence	ImobS3, Clermont-Ferrand, Fr

## Positions

2016-...	<b>Research director (equivalent to full professor)</b> Leading researches in the fields of off-road mobile robots.	Irstea
2010-2015	<b>Senior researcher</b>	Irstea
2006-2010	<b>Junior researcher</b>	Irstea
2006	<b>Post doctoral researcher</b> Adaptive control of systems submitted to variable friction	Lund University, Sweden

## Research contributions and impact

My research activities are devoted to the autonomous navigation of off-road mobile robots. I have developed an important activity around the modelling, the perception and the control of wheeled mobile robot. An original methodology arising allowing to preserve the accuracy despite high perturbations encountered off-road and the stability and integrity for the robot. This work has been recognized nationally and at international thanks to the results obtained. Some of the control approach are becoming to be generic since they I was invited in co-writing a chapter on control of wheeled mobile robots in the Springer Handbook of robotics, which is a reference in the robotic community. Some of these algorithms are then used in several internationally recognized team in mobile robotics.

### Project coordination skills

Since the beginning of my researcher activities, I have lead 3 National research project of 3 years (with at least 4 participant each) and 5 project with private companies. I have also been involved in 2 european and 4 national projects as responsible of workpackages.

## Honor and Awards

2018	Francis Sevila Young Professional Award, given by EurAgEng
2018	Sedimaster Award
2006	Best Interactive Session Award at IEEE CDC2006 : 45th IEEE Conference on Decision and Control
2006	Silver medal of French Agriculture Academy

<sup>1</sup> Highest diploma in the french academia system



## Bibliography (since 2015)

<b>Publications since 2015</b>	
<i>Book chapter</i>	2
<i>Journal (Rank A)</i>	10
<i>Invited conferences (Rank A)</i>	8
<i>Conferences (Rank A)</i>	24

<b>Bibliometry</b>	
<i>Hindex</i>	22 (GS), 18 (RG), 16 (Scopus)
<i>Citations</i>	1469 (GS), 1000 (RG), 853 (Scopus)
<i>i10</i>	36 (GS), 27 (Scopus)


## Selected Projects

AdaP2e		Adaptive Autonomous Production Platform for Environment	
ANR Jeunes Chercheurs		Période : 2014-2018 (42m)	
Partnership : Irstea TSCF – ITAP - TSAN			
Project Leader		Funds : 356.000€	
<p>This research project aims to develop new robotics tools for the environment and agriculture in order to increase the efficiency of the operations to be carried out in natural environments to improve the control of the environmental quality. In order to ensure a high level of efficiency, the project envisages the development of an integrated and reconfigurable demonstrator. It brings together multidisciplinary work (decision / perception / action / security) in order to propose a platform capable of selecting several modes of autonomous operations and potentially in collaboration with the man in order to guarantee a functioning always adapted to the reality context. Given the collaborations of Irstea, the scientific interest and the potentialities offered, an application support residing in wine operations will be privileged in this project.</p> <p><a href="https://adap2e.irstea.fr">https://adap2e.irstea.fr</a></p>			







PumAgri		Plateforme Universelle Mobile pour l'AGRIculture	
Type: FUI		Période : 2015-2018 (36m)	
Partenaires : Irstea TSCF – Sitia – VisioNerfs – LARIS (Univ Angers)			
Irstea manager and contributor for control and safety part		Funds Irstea : 236.000€	
The aim of this project is to realize a modular multi-tool mobile robot for the automation of agricultural processes in order to increase the competitiveness of the farms. In this project, the aim is to adapt the algorithm for perception and control of mobility and to develop a cross-border management module using low-cost sensors.			

A photograph showing a mobile robot, which is a small, dark-colored vehicle with a green canopy, operating inside a large greenhouse. The robot is positioned in the center of the frame, facing away from the camera. It is surrounded by long, straight rows of young plants in the ground. The greenhouse structure is made of a translucent plastic covering supported by a metal frame. In the background, a red and white trailer is visible outside the greenhouse entrance. The lighting is bright, suggesting daytime.




<b>Baudet-Rob + Baudet-Ro Maturation</b>	<b><i>Robot mobile d'assistance logistique pour une mobilité des groupes d'intervention plus efficace, plus réactive et plus sûre.</i></b>	
Type: ASTRID-DGA (initialement REI-DGA)	Période : 2011-2014 + 2016-2018	
Partership : Effidence, Irstea, Institut Pascal,		
Contributor for control part	Funds : 300.000€ + 500.000€	
Responsible of the control design on several kinds of robot for people tracking in natural environment. It comprises adaptive and predictive control in order to ensure the path admissibility, the robot integrity and accuracy warranty during following. Applications are focused on automated carrier for persons assistance		







<i>ActiSurTT</i>		<i>Dispositifs actifs pour la sécurité des véhicules en environnement tout-terrain</i>	
Type: ANR – Programme VTT		Période : 2011-2014	
Partership : Irstea, LSIS, Xlim, Institut Pascal, CCMSA, Cetim, Axema, PhiMeca, Grégoire, Poclain Hydraulics		Portée : nationale	
Project Leader		Funds : 1.321.600€	
<p>This project is dedicated to the design of active security devices for off-road machines. The objective is to investigate the capabilities of detection and avoidance of rollover situations aas well as loss of controllability. It comprises the indirect estimation of risk using existing sensors, as well as the design of new perception and control devices to anticipate for risky situations.</p> <p><a href="https://actisurtt.irstea.fr">https://actisurtt.irstea.fr</a></p>			





SafePlatoon		Sûreté de convois de véhicules autonomes	
Type: ANR – Programme VTT	Période : 2011-2014		
Partership : SeT, Irstea, Institut Pascal, CIVITEC		Portée : nationale	
In charge control workpackage		Aide : 827.000€	
<p>This project aim at designing a fleet of autonomous robots moving in several coordinated formation. I am in charge of the architecture control design allowing the accurate relative positionning in different conditions (several kinds of robot, different desired shapes, variable grip conditions). Beyond the positionning accuracy, the control design comprises the integrity preservation of the robots formation (stability, collision avoidance, ...)</p> <p><a href="http://web.utbm.fr/safeplatoon/">http://web.utbm.fr/safeplatoon/</a></p>			





FAST		Fast Autonomous Rover SysTem	
Type: ANR – Programme PSIROB	Période : 2008-2012		
Partership : FR TIMS (Irstea and Institut Pascal), LAAS, ISIR, RoboSoft		Portée : nationale	
Project Leader		Aide : 853.000€	
In this project, the design of a fast and stable mobile robot, using possible configuration is investigated in terms of mechanical design, perception capability, and control development. The idea is to succeed in moving as fast as possible in uncertain terrain while preserving the accuracy (some centimeters) and the stability of an autonomous device. <a href="https://projetfast.cemagref.fr/avancee">https://projetfast.cemagref.fr/avancee</a>			



## Selected papers (2015-2017)

- 2017 Roland Lenain, Pascal Morin, Claude Samson.  
***Motion Control of Wheeled Mobile Robots*** Chapter 49 in “Handbooks of Robotics, 2<sup>nd</sup> edition”, Springer.
- 2017 Audrey Guillet, Roland Lenain, Benoit Thuilot, Vincent Rousseau  
***Formation control of agricultural mobile robots: a bi-directional weighted constraints approach***, Journal of Field Robotics 34(7), 1260-1274
- 2017 Roland Lenain, Mathieu Deremetz, Jean-Baptiste Braconnier, Benoit Thuilot, Vincent Rousseau  
***Robust sideslip angles observer for accurate off-road path tracking control***, Advanced Robotics 31 (9) 453-467
- 2017 Krid, M. and Ben Amar, F. and Lenain, R. ***A new explicit dynamic path tracking controller using Generalized Predictive Control***. International Journal of Control, Automation and Systems, 15 (1), 303-314

- 2017 Piron, E.; Chateauneuf, A.; Miclet, D.; Lenain, R.; Koko, J.  
***On-the-field simulation of fertilizer spreading: Part 1—Modeling.*** *Computers and Electronics in Agriculture, Elsevier, (142)* 235-247
- 2017 Piron, E.; Chateauneuf, A.; Miclet, D.; Lenain, R.; Koko, J.  
***On-the-field simulation of fertilizer spreading: Part 2--Uniformity investigation.*** *Computers and Electronics in Agriculture, Elsevier, 2017, 141,* 118-130
- 2016 Denis, D. ; Lenain, R. ; Thuilot, B.  
***Online Adaptive Observer for Rollover Avoidance of Reconfigurable Agricultural Vehicles,*** *Computer And Electronics in Agriculture* 126, 32-43.
- 2015 Eric Lucet, Roland Lenain, Christophe Grand  
***Dynamic path tracking control of a vehicle on slippery terrain,*** in *Control Engineering Practice* 42, 60-73
- 2017 Deremetz, M.; Lenain, R.; Thuilot, B. & Rousseau, V.  
***Adaptive trajectory control of off-road mobile robots: A multi-model observer approach.*** *Robotics and Automation (ICRA), 2017 IEEE International Conference on, 2017, 4407-4413*
- 2017 Deremetz, M.; Lenain, R. & Thuilot, B.  
***Stiffness and damping real-time control algorithms for adjustable suspensions: A strategy to reduce dynamical effects on vehicles in off-road conditions.*** *IFAC-PapersOnLine, Elsevier, 2017, 50,* 1958-1964
- 2016 Jean-Baptiste Braconnier, Roland Lenain, Benoit Thuilot  
***High speed path tracking application in harsh conditions: Predictive speed control to ensure the limit of the lateral deviation.*** *IEEE/RSJ International conference on intelligent robots and systems, IROS2016*
- 2016 Ange Nizard, Benoit Thuilot, Roland Lenain  
***Nonlinear Path Tracking Controller for Bi-Steerable Vehicles in Cluttered Environments, IAV 2016 9th IFAC Symposium on Intelligent Autonomous Vehicles***
- 2015 Ange Nizard, Benoit Thuilot, Roland Lenain  
***Tire longitudinal grip estimation for improved safety of vehicles in off-road conditions,*** *Robotics and Automation (ICRA), 2015 IEEE International Conference on, 3368-3373*