

# Olivier Mullier | Postdoctoral researcher

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## Positions

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Current position.....

### ENSTA Paristech

Palaiseau

Postdoctoral research

Since May, 2016

- Subject : validated numerical integration with Runge Kutta methods and computation of the viability kernel of controlled dynamical systems;
- collaborator : Alexandre Chapoutot - ENSTA Paristech;
- keywords : validated numerical integration, interval analysis, affine arithmetic, viability kernel, reachability, Lyapunov functions.

Previous postions.....

### Polytech'

Orléans

Postdoctoral research

From April, 2015 to February, 2016

- Subject : employability of students in earthscience;
- collaborators :
  - Estelle Courtial - Polytech' Orléans,
  - Christelle Garrouste - université Paris-Est Créteil (UPEC);
- keywords : modeling, discrete time dynamical systems, flatness of controlled systems, inner approximation, interval analysis, affine arithmetic.

### ENSTA Paristech

Palaiseau

Postdoctoral research

From December, 2014 to February, 2015

- Subject : Computation of the local troncation error of Runge-Kutta methods for validated numerical integration;
- collaborator : Alexandre Chapoutot - ENSTA Paristech;
- keywods : validated numerical integration, Runge-Kutta methods, Butcher series, automatic differentiation.

## Academic background

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### École Polytechnique

Palaiseau

PHD in computer science

2014

PHD thesis in computer science (section CNU 27) from École Polytechnique made at CEA (French commission to atomic energy) LIST DILS in the laboratory MéASI (Methods and analysis of interacting systems). Thesis defended the 7<sup>th</sup> of May, 2014.

- Title : *Inner approximation of the range of vector-valued functions*;
- funding : Digiteo DIM LSC project SANSCRIT, Inner approximation for static analysis and robust control;
- supervisor : Éric Goubault - École polytechnique;
- assistant supervisors :
  - Michel Kieffer - Supélec,
  - Sylvie Putot - École polytechnique;
- jury president : Michel Rueher - université Côte d'Azur, Polytech' Nice-Sophia;
- protactors :
  - Laurent Granvilliers - université de Nantes,
  - Luc Jaulin - ENSTA Bretagne;
- examiners :
  - Nathalie Revol - ENS Lyon,
  - Siegfried Rump - université de technologie d'Hambourg, université de Waseda.

### Université de Nantes

**Nantes**

*MSC in computer science, specialty optimization in operation research (ORO)*

2010

- Msc thesis : Solving ordinary differential equation based constraints in the constraint programming framework (6 month internship at National Institute of Informatics (NII), Tokyo);
- supervisors :
  - Alexandre Goldsztejn - université de Nantes,
  - Hiroshi Hosobe - National Institute of Informatics (NII), Tokyo.

### Université François Rabelais

**Tours**

*Bachelor degree in computer science*

2007

### Université François Rabelais

**Tours**

*DEUG MIAS (mathematics, computer science and application to sciences)*

2006

## Projects

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- **2018–2021** DGA MRIS project. Meetings and seminars.  
**Consortium** : École polytechnique, ENSTA Bretagne, ENSTA ParisTech, ISAE;  
**Research focus**: Validation for drones and swarms of drones.
- **2015–2021** Chair ingénierie des systèmes complexes. Meetings and seminars.  
**Consortium industriel** : Thalès, Dassault-Aviation, DCNS et DGA;  
**Consortium académique** : École polytechnique, ENSTA Paristech et Télécom Paristech;  
**Research focus**: define new formalism and methods to analyse and verify cyberphysical systems.
- **2015–2018** DGA MRIS project : robotic complex systems operation safety. Meetings and seminars.  
**Consortium** : École polytechnique, ENSTA Bretagne, ENSTA ParisTech;  
**Research focus**: define new methods to prove correctness in trajectory planning.
- **2015–2016** EDIFICE project (labex Voltaire). Meetings.  
**Research focus**: CIPEGE tool (Centre International de Perspectives pour l'Emploi en Géosciences et Environnement).
- **2017–2020** ANR CONTREDO. outsider from the project, participation to the kick off meeting.  
**Consortium** : LIRMM, EMN, ENPC, ENSTA Bretagne, ENSTA ParisTech, MBDA;  
**Research focus**: Intervals and contractors for the dynamical systems.

## Languages

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**French**: Mother tongue

**English**: Fluent

## Scientific community involvement

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- International workshop organiser :
  - member of the program and organizing committee for the workshop SWIM (Summer Workshop on Interval Methods) 2019;
- reviewer for several journals.

## Prix

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- Best repeatability: Benjamin Martin and Olivier Mullier. Improving validated computation of Viability Kernels. In *the 21st International Conference on Hybrid Systems: Computation and Control*, Porto, France, April 2018. ACM Press.

## Teaching

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**IN101:** Algorithmique et programmation (16h - january 2013), ENSTA ParisTech

**INF301:** Introduction à l'informatique (40h - june 2013), École polytechnique

**INF421:** Les bases de la programmation et de l'algorithmique (40h - October 2013), École polytechnique

**IN102:** Programmation en langage C (12h - november 2016), ENSTA ParisTech

**IN103:** Système et programmation (12h - january 2017), ENSTA ParisTech

**MATLAB:** Introduction to matlab (6h - september 2017), ENSTA ParisTech

## Encadrement

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- **March to August 2019** Master internship advisor for Amit Kumar (Centrale Nantes).

## Publications

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**Journal**.....  
Olivier Mullier, Éric Goubault, Michel Kieffer, and Sylvie Putot. General inner approximation of vector-valued functions. *Reliable Computing*, 18:pp. 117–143, November 2013.

Julien Alexandre dit Sandretto, Alexandre Chapoutot, and Olivier Mullier. Formal Verification of Robotic Behaviors in Presence of Bounded Uncertainties. *Journal of Software Engineering for Robotics*, 8(1):78–88, 2017.

Olivier Mullier and Estelle Courtial. Set-membership computation of admissible controls for trajectory tracking. *Reliable Computing*, 24:pp. 11–26, April 2017.

Olivier Mullier, Alexandre Chapoutot, and Julien Alexandre dit Sandretto. Validated Computation of the Local Truncation Error of Runge-Kutta Methods with Automatic Differentiation. *Optimization Methods and Software*, 2018.

**Book chapters**.....  
Julien Alexandre Dit Sandretto, Alexandre Chapoutot, and Olivier Mullier. Constraint-Based Framework for Reasoning with Differential Equations. In Çetin Kaya Koç, editor, *Cyber-Physical Systems Security*, page 23–41. Springer International Publishing, December 2018.

## Conference Talks.....

Alexandre Goldsztejn, Olivier Mullier, Damien Eveillard, and Hiroshi Hosobe. Including ordinary differential equations based constraints in the standard cp framework. *Principles and Practice of Constraint Programming–CP 2010*, page 221–235, 2010.

Éric Goubault, Olivier Mullier, Michel Kieffer, and Sylvie Putot. Inner approximated reachability analysis. In *The International Conference on Hybrid Systems: Computation and Control (HSCC)*, April 2014.

Julien Alexandre dit Sandretto, Alexandre Chapoutot, and Olivier Mullier. Tuning PI controller in non-linear uncertain closed-loop systems with interval analysis. In *2nd International Workshop on Synthesis of Complex Parameters (SynCoP'15)*, volume 44, page 91–102, Dagstuhl, Germany, 2015.

Julien Alexandre dit Sandretto, Alexandre Chapoutot, and Olivier Mullier. Formal Verification of Robotic Behaviors in Presence of Bounded Uncertainties. In *First IEEE International Conference on Robotic Computing*, Taichung, Taiwan, April 2017.

Benjamin Martin and Olivier Mullier. Improving validated computation of Viability Kernels. In *the 21st International Conference on Hybrid Systems: Computation and Control (HSCC)*, Porto, Portugal, April 2018. ACM Press.

Olivier Mullier and Julien Alexandre dit Sandretto. Set-membership Computation of Integrals with Uncertain Endpoints. In *Numerical Computations: Theory and Algorithms NUMTA 2019*, Le Castella, Italy, June 2019.

## Seminaries.....

Alexandre Goldsztejn, Olivier Mullier, Damien Éveillard, and Hiroshi Hosobe. Including ordinary differential equations based constraints in the standard CP framework. In *Small Workshop on Interval Methods*, Nantes, France, June 15-16 2010.

Olivier Mullier. Under-approximation of the range of vector-valued functions extended, small workshop on interval methods. bourges. In *Small Workshop on Interval Methods*, Bourges, France, 2011.

Olivier Mullier. Under-approximation of the range of vector-valued functions having different dimensions for domain and codomain. In *Seminary 11371: Uncertainty modeling and analysis with intervals: Foundations, tools, applications*, Dagstuhl, Germany, 2011.

Alexandre Chapoutot, Julien Alexandre dit Sandretto, and Olivier Mullier. Set-membership computation of admissible controls for trajectory tracking. In *Small Workshop on Interval Methods*, Prague, Czech Republic, June 2015.

Alexandre Chapoutot, Julien Alexandre dit Sandretto, and Olivier Mullier. Validated Explicit and Implicit Runge-Kutta Methods. In *Small Workshop on Interval Methods*, Prague, Czech Republic, June 2015.

Olivier Mullier, Julien Alexandre dit Sandretto, and Alexandre Chapoutot. Optimal switching instants for the control of hybrid systems. In *Summer Workshop on Interval Methods*, Rostock, Germany, July 2018.

## Posters.....

Olivier Mullier, Alexandre Chapoutot, and Julien Alexandre dit Sandretto. Validated computation of the local truncation error of runge-kutta methods with automatic differentiation. In *AD2016 - 7th International Conference on Algorithmic Differentiation*, 2016.

Preprints.....

Julien Alexandre dit Sandretto, Alexandre Chapoutot, and Olivier Mullier. Survey of what Dynlbex can do for you. working paper, November 2018.