Curriculum Vitae
Michel Duprez

Inria Senior Researcher

Team-project Inria MIMESIS
MLMS Team, Icube
Université de Strasbourg
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67000 Strasbourg
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Born 15 April 1985
French citizenship

Professional experience

2020 – **Inria Senior Researcher** *Inria Nancy Grand-Est team-project MIMESIS, laboratory Icube team MLMS,* Université de Strasbourg

2019 – 2020 **Assistant professor** *CEREMADE, MIDO,* Université Paris Dauphine.

2018 – 2019 **Post-doc position** *LJLL* Sorbonne Université
Supervisors: Yannick Privat and Grégoire Nadin. Subject: "Optimisation problems arising in biology".
Supported by Fondation Sciences Mathématiques de Paris.

2016 – 2018 **Post-doc position** *I2M, LSIS* Université Aix-Marseille
Supervisors: Francesco Rossi and Morgan Morancey. Subject: "Control problems arising in crowd motion".
Supported by Labex Archimède.

2015 – 2016 **Full-time ATER (assistant professor)** *LMB, Université de Franche-Comté, France*
Duration: 192h.

2012 – 2015 **Teaching contracts** *UFR-ST, Université de Franche-Comté, France*
Duration: 3×64h.

Education

2025 **Habilitation à Diriger des Recherches (French accreditation to supervise research)** *Université de Strasbourg, France.*
Subject: A priori and a posteriori estimates of finite element schemes and development of commands for some dynamic phenomena.
Defended on November 21, 2025.

2012 – 2015 **Ph.D. in Applied Mathematics** *Université de Franche-Comté, France.* Advisers: Farid Ammar Khodja, Boris Andreianov and Franz Chouly
Subject: Controllability of some systems governed by parabolic equations.
Supported by Région Franche-Comté.
Defended on November 26, 2015.

2011 – 2012 **Master of research: partial differential equations and numerical analysis** *Université de Franche-Comté, France*
Subject: Approximate controllability, optimization and numerical convergence of a scheme for parabolic linear equations.

2011 **Agrégation of Mathematics (French national competitive examination)**
Rank: 146th.

2010 – 2011 **Master of Professional Studies "History of science"** *Université de Franche-Comté, France*
Adviser: Stefan Neuwirth. Subject: "Les Sphériques de Ménélaüs".

2010 **Capes of Mathematics (French national competitive examination)**
Rank: 58th.

Research interests

Optimal Control Problems Applied to Biology and Medicine
Epidemiology, neuroscience, modelling, optimisation

Development of numerical tools for soft tissue simulation
Finite element method, neural networks, a priori estimates, a posteriori estimates

Distinctions

2025 – 2027 **RIPEC C3**

2020 – 2023 **PEDR** *Inria Starting*

Grants and projects

2026 – 2027 **Principal investigator of the CNRS-MITI project OPTISTENT** *"Designing patient-specific stents by shape optimisation"*. Budget: 40 k€

2026 – 2027 **International coordinator of the MATH-AmSud project NeuralFEM** *"Certified neural networks for non-smooth biomechanical problems"*. Consortium of 16 researchers (Uruguay, Colombia, Chile, France). Budget: 48.5 k€

2024 – 2029 **Participant in the project PREMYOM** *"Personalised myopia-control lenses and care pathway, digital twin of the myopic eye"*. Leader: Essilor.

2023 – 2028 **Participant in the project MEDITWIN** *"A European and sovereign platform of digital twins for healthcare"*. Leader: Dassault Systèmes. Budget: 132 M€

2022 – 2026 **Principal investigator of the project ANR JCJC ϕ-FEM** *"ϕ-FEM: development of a Finite Element Method for the design of real-time digital twins in surgery"*. Budget: 320 k€

2022 – 2026 **Participant in the project ANR S-KELOID** *"Understanding Keloid Disorders: A multi-scale in vitro/in vivo/in silico approach towards digital twins of skin organoids on the chip"*. Leaders: R. Eftimie (France) and S. Bordas (Luxembourg) Budget: 575 k€

2021 – 2025 **Participant in the project ANR TRECOS** *"New TREnds in COntrol and Stabilization"*. Leader: S. Ervedoza Budget: 300 k€

2018 **Participant in the project STIC-AmSud MEMBICA** *"NEw Methods for BIological Control of the Arboviruses"*. Leader: P.-A. Bliman Budget: 15 k€

Supervision

Post-docs

2024 – **Raphaël Bulle:** *co-supervised with V. Lleras and R. Becker. "A posteriori error estimators for immersed boundary methods"*

Ph.D. students

2025 – **Louis Ducongé:** *co-supervised with Y. Privat and S. Cotin. "Designing patient-specific stents by shape optimisation"*

2025 – **Even Harsigny:** *co-supervised with P. Alvarez and S. Cotin. "Building a digital twin of the eye to fight myopia"*

2025 – **Ilias Nahmed:** *co-supervised with P. Alvarez and S. Cotin. "Computer-assisted liver tumour ablation using an AI-based digital twin"*

2025 – **Francesco Dettori:** *co-supervised with P. Alvarez and S. Cotin. "Image registration for liver tumour ablation using an AI-based digital twin"*

2023 – **Frédérique Lecourtier:** *co-supervised with V. Lleras and E. Franck. "Finite element methods and neural networks for augmented surgery"*

2022 – **Killian Vuillemot:** *co-supervised with V. Lleras and B. Mohammadi. "Non-conforming finite element methods for the design of digital twins of organs"*

2021 – 2024 **Valentina Scarponi:** *co-supervised with F. Nageotte and S. Cotin. "Catheter insertion"*

2021 – 2024 **Thomas Wahl:** *co-supervised with A. Hutt. "Model-based closed-loop neurostimulation with application to schizophrenia"*

Master students

2025 **Francesco Dettori** *(M2), Even Harsigny (M2), Louis Ducongé (M2), Ilias Nahmed (M2) and Tom Pitois (M1)*
Co-supervised with S. Cotin, P. Alvarez, Y. Privat, Y. Dumont, P. Rastin and G. Cabanes.

2024 – 2025 **Justine Ehret and Rénée Portillo-Navarrete** *(M2 mini-project): co-supervised with S. Cotin and P. Alvarez. "Muscle activation in the eye"*

2024 **Francesco Dettori** *(M1): co-supervised with S. Cotin and F. Nageotte. "FBG tracking for catheter navigation"*

2023 **Frédérique Lecourtier** *(M2): co-supervised with E. Franck and S. Cotin. "Finite element methods and neural networks for augmented surgery"*

2022 **Killian Vuillemot** *(M2): co-supervised with S. Cotin. "Developing non-conforming finite element methods for computer-assisted surgery"*

2021 **Vincent Italiano** *(M1): co-supervised with Y. Privat. "Epidemic control strategies"*

2021 **Philippe Pincon** *(M2): co-supervised with F. Jourdes. "Updating sparse Cholesky factorisations in the context of interactive surgical simulation"*

2021 **Killian Vuillemot** *(M1): co-supervised with S. Cotin. "Developing non-conforming finite element methods for computer-assisted surgery"*

2020 – 2021 **Philippe Pincon** *(M2 mini-project): co-supervised with F. Jourdes. "Assessing approaches to organ–organ interaction for surgical simulation"*

2020 – 2021 **Roussel Nzoyem** *(M2 mini-project): co-supervised with S. Cotin. "Simulating soft tissue with innovative non-conforming finite element methods (ϕ-FEM)"*

2019 **Romane Hélie** *(M2): co-supervised with Y. Privat. "Control strategies for fighting arboviruses"*

Scientific responsibilities

2021 – **Organiser of the MLMS and MIMESIS team seminar** *Strasbourg*
`https://mlms.icube.unistra.fr/en/index.php/Seminars`

2022 – **Member of the centre committee** *Inria Nancy Grand Est centre*

2022 **Member of the hiring committee for Inria junior researchers** *Inria Nancy Grand Est centre*

2014 – 2016 **Ph.D. student representative** *Carnot-Pasteur doctoral school, Bourgogne Franche-Comté*

2014 – 2016 **Head of the Ph.D. student seminar** *LMB, Besançon*

Reviewer for *SEMA SIMAI, Journal of Differential Equations, Systems & Control Letters, ESAIM: COCV, Mathematics of Control, Signals and Systems, IEEE Transactions on Control Systems Technology, Journal of Dynamical and Control Systems, North Western European Journal of Mathematics, Evolution Equations & Control Theory, Advanced Modeling and Simulation in Engineering Sciences, Radon Series on Computational and Applied Mathematics, Mathematical Control and Related Fields, Nonlinear Analysis: Real World Applications.*

Preprints

[A38] R. Bulle, M. Duprez, V. Lleras, K. Vuillemot. A multigrid and neural network approach to reduce the computational cost of ϕ-FEM.

[A37] R. Bulle, M. Duprez, V. Lleras, K. Vuillemot. A penalized ϕ-FEM scheme for the Poisson Dirichlet problem.

[A36] R. Becker, R. Bulle, M. Duprez, V. Lleras. Residual-based a posteriori error estimates with boundary correction for ϕ-FEM.

Accepted articles

[A35] F. Dettori, I. Nahmed, M. Duprez, J. Verde, P. Alvarez, S. Cotin. Personalization of Liver Microwave Ablation Simulation. *Int. J. Comput. Assist. Radiol. Surg. (2026)*

[A34] E. Harsigny, P. Alvarez, M. Duprez, S. Cotin. A differentiable simulation of the eye for patient-specific strabismus surgery planning. *Int. J. Comput. Assist. Radiol. Surg. (2026)*

[A33] I. Nahmed, F. Dettori, J. Verde, M. Duprez, P. Alvarez, S. Cotin. A digital twin for microwave liver treatment replanning. *Int. J. Comput. Assist. Radiol. Surg. (2026)*

[A32] H. Barucq, M. Duprez, F. Faucher, E. Franck, F. Lecourtier, V. Lleras, V. Michel-Dansac, N. Victorion. Enriching continuous Lagrange finite element approximation spaces using neural networks. *ESAIM: M2AN 60 (2026), no. 2, pp. 541-603*

[A31] M. Duprez, V. Lleras, A. Lozinski, V. Vigon, K. Vuillemot. ϕ-FEM-FNO: a new approach to train a Neural Operator as a fast PDE solver for variable geometries. *Commun. Nonlinear Sci. Numer. Simul. 152 (2026), Part A, 109131*

[A30] R. Becker, F. Chouly, M. Duprez, T. Richter, P.-Y. Rohan, T. Wick. Dual Weighted Residual-driven adaptive mesh refinement to enhance biomechanical simulations. *Advances in Applied Mechanics 61 (2025), pp. 75-127*

[A29] Y. Dumont, M. Duprez, Y. Privat. Sterile Insect Technique in a Two-Patch Model: Effects of Migration Rates on Optimal Control Strategies for Single-Patch Releases. *J. Math. Biol. 91, 71 (2025)*

[A28] M. Duprez, V. Lleras, A. Lozinski, V. Vigon, K. Vuillemot. ϕ-FD: a well-conditioned finite difference method inspired by ϕ-FEM for general geometries on elliptic PDEs. *J. Sci. Comput. 104 (2025), article no. 23*

[A27] H.-P. Bui, M. Duprez, P.-Y. Rohan, A. Lejeune, S. P. A. Bordas, M. Bucki, F. Chouly. Enhancing Biomechanical Simulations Based on A Posteriori Error Estimates: The Potential of Dual Weighted Residual-Driven Adaptive Mesh Refinement. *Int. J. Numer. Meth. Biomed. Engng. 41 (2025), e3897*

[A26] V. Scarponi, J. Verde, N. Haouchine, M. Duprez, F. Nageotte, S. Cotin. FBG-driven simulation for virtual augmentation of fluoroscopic images during endovascular interventions. *Healthcare Technology Letters (2024)*

[A25] V. Scarponi, M. Duprez, F. Nageotte, S. Cotin. A Zero-Shot Reinforcement Learning Strategy for Autonomous Guidewire Navigation. *Int. J. Comput. Assist. Radiol. Surg. 19 (2024), pp. 1185-1192*

[A24] Y. Dumont, M. Duprez. Modeling the impact of rainfall and temperature on sterile insect control strategies in a Tropical environment. *J. Biol. Syst. 32 (2024)*

[A23] M. Duprez, V. Lleras, A. Lozinski, K. Vuillemot. ϕ-FEM for the heat equation: optimal convergence on unfitted meshes in space. *C. R. Math. 361 (2023), pp. 1699-1710*

[A22] M. Duprez, A. Hutt, T. Wahl. Delayed closed-loop neurostimulation for the treatment of pathological brain rhythms in mental disorders. *Front. Neurosci., Sec. Neural Technology, Vol. 17 (2023)*

[A21] M. Duprez, D. Souza, M. Gonzalez-Burgos. Remarks on the controllability of parabolic systems with non-diagonalizable diffusion matrix. *Discrete Contin. Dyn. Syst. Ser. S 16 (2023), no. 6, pp. 1346-1382*

[A20] M. Duprez, V. Lleras, A. Lozinski. ϕ-FEM: an optimally convergent and easily implementable immersed boundary method for particulate flows and Stokes equations. *ESAIM: M2AN 57 (2023), pp. 1111-1142*

[A19] M. Duprez, V. Lleras, A. Lozinski. A new ϕ-FEM approach for problems with natural boundary conditions. *Numer. Methods Partial Differ. Equ. 39 (2023), no. 1, pp. 281-303*

[A18] L. Almeida, M. Duprez, Y. Privat, N. Vauchelet. Optimal control strategies for the sterile mosquitoes technique. *J. Differential Equations 311 (2022), pp. 229-266*

[A17] M. Duprez, P. Lissy. Bilinear local controllability to the trajectories of the Fokker-Planck equation with a localized control. *Ann. Inst. Fourier 72 (2022), no. 4, pp. 1621-1659*

[A16] M. Duprez, R. Hélie, Y. Privat, N. Vauchelet. Optimization of spatial control strategies for population replacement, application to Wolbachia. *ESAIM Control Optim. Calc. Var. 27 (2021), Paper No. 74, 30 pp.*

[A15] P.-A. Bliman, M. Duprez, Y. Privat, N. Vauchelet. Optimal immunity control by social distancing for the SIR epidemic model. *J. Optim. Theory Appl. 189 (2021), pp. 408-436*

[A14] P.-A. Bliman, M. Duprez. How Best Can Finite-Time Social Distancing Reduce Epidemic Final Size?. *J. Theoret. Biol. 511 (2021)*

[A13] M. Duprez, A. Lozinski. ϕ-FEM: a finite element method on domains defined by level-sets. *SIAM J. Numer. Anal. 58 (2020), no. 2, pp. 1008-1028*

[A12] M. Duprez, M. Morancey, F. Rossi. Minimal time for the continuity equation controlled by a localized perturbation of the velocity vector field. *J. Differential Equations 269 (2020), no. 1, pp. 82-124*

[A11] M. Duprez, A. Koenig. Control of the Grushin equation: non-rectangular control region and minimal time. *ESAIM Control Optim. Calc. Var. 26 (2020), 3*

[A10] M. Duprez, S. Bordas, M. Bucki, P. Bui, F. Chouly, V. Lleras, C. Lobos, A. Lozinski, P.-Y. Rohan, S. Tomar. Quantifying discretization errors for soft-tissue simulation in computer assisted surgery: a preliminary study. *Appl. Math. Model. 77 (2020), part 1, pp. 709-723*

[A9] M. Duprez, A. Lozinski, V. Lleras. Finite element method with local damage of the mesh. *ESAIM Math. Model. Numer. Anal. 53 (2019), no. 6, pp. 1871-1891*

[A8] L. Almeida, M. Duprez, Y. Privat, N. Vauchelet. Mosquito population control strategies for fighting against arboviruses. *Math. Biosci. Eng. 16 (2019), no. 6, pp. 6274-6297*

[A7] M. Duprez, M. Morancey, F. Rossi. Approximate and exact controllability of the continuity equation with a localized vector field. *SIAM J. Control Optim. 57 (2019), no. 2, pp. 1284-1311*

[A6] M. Duprez, G. Olive. Compact perturbations of controlled systems. *Math. Control Relat. Fields 8 (2018), no. 2, pp. 397-410*

[A5] M. Duprez, P. Lissy. Positive and negative results on the internal controllability of parabolic equations coupled by zero and first order terms. *J. Evol. Equ. 18 (2018), no. 2, pp. 659-680*

[A4] M. Duprez, A. Perasso. Criterion of positivity for semilinear problems with applications in biology. *Positivity 21 (2017), no. 4, pp. 1383-1392*

[A3] M. Duprez. Controllability of a 2×2 parabolic system by one force with space-dependent coupling term of order one. *ESAIM Control Optim. Calc. Var. 23 (2017), no. 4, pp. 1473-1498*

[A2] M. Duprez, P. Lissy. Indirect controllability of some linear parabolic systems of m equations with $m-1$ controls involving coupling terms of zero or first order. *J. Math. Pures Appl. (9) 106 (2016), no. 5, pp. 905-934*

[A1] F. Ammar-Khodja, F. Chouly, M. Duprez. Partial null controllability of parabolic linear systems. *Math. Control Relat. Fields 6 (2016), no. 2, pp. 185-216*

Book chapters

[C2] S. Cotin, M. Duprez, V. Lleras, A. Lozinski, K. Vuillemot. ϕ-FEM: an efficient simulation tool using simple meshes for problems in structure mechanics and heat transfer. *Partition of Unity Methods*, Wiley Series in Computational Mechanics, 2023.

[C1] L. Almeida, J. Bellver Arnau, M. Duprez, Y. Privat. Minimal cost-time strategies for mosquito population replacement. *Optimization and Control for Partial Differential Equations*, Radon Series on Computational and Applied Mathematics 29, De Gruyter, 2022.

Peer-reviewed proceedings

[P7] I. Nahmed, F. Dettori, M. Duprez, P. Alvarez, S. Cotin. A Deep Learning Surrogate Model for Microwave Thermal Ablation: From Preoperative Planning to Intraoperative Re-planning. *MICCAI 2026*, Strasbourg, France, 2026.

[P6] F. Dettori, I. Nahmed, M. Duprez, P. Alvarez, S. Cotin. Real-Time Interactive MWA Planning via Probabilistic Inverse Inference. *MICCAI 2026*, Strasbourg, France, 2026.

[P5] V. Scarponi, J. Verde, N. Haouchine, M. Duprez, F. Nageotte, S. Cotin. FBG-driven simulation for virtual augmentation of fluoroscopic images during endovascular interventions. *AE-CAI / CARE / OR 2.0, MICCAI 2024 workshop*, Marrakech, Morocco, October 2024.

[P4] V. Scarponi, F. Lecomte, M. Duprez, F. Nageotte, S. Cotin. Autonomous Guidewire Navigation in Dynamic Environments. *International Conference on Intelligent Robots and Systems (IROS)*, Abu Dhabi, United Arab Emirates, 2024.

[P3] Y. Dumont, M. Duprez, Y. Privat. About sterile insect control strategies in a two patches system. *BIOMATH 2023*, Pomorie, Bulgaria, June 2023.

[P2] M. Duprez, M. Morancey, F. Rossi. Minimal time problem for discrete crowd models with a localized vector field. *57th IEEE Conference on Decision and Control*, Miami Beach, FL, USA, December 17-19, 2018.

[P1] M. Duprez, M. Morancey, F. Rossi. Controllability and optimal control of the transport equation with a localized vector field. *25th Mediterranean Conference on Control and Automation (MED)*, Valletta, Malta, July 3-6, 2017.

Posters

[Pos2] R. Bulle, S. Cotin, L. Ducongé, M. Duprez, J. Diaz-Avalos, A. Laurain. Shape optimization using ϕ-FEM. *FEniCS conference 2026*, Paris, France.

[Pos1] M. Duprez, P. Lissy. Indirect controllability of some linear parabolic systems of two equations with one control involving coupling terms of first order. *Contrôlabilité des EDP et applications*, CIRM, Marseille, November 9-13, 2015.

Software

[S1] R. Bulle, M. Duprez, K. Vuillemot. phiFEM: a convenience package for using phiFEM with FEniCSx. *Software*, 2025. github.com/PhiFEM

Oral presentations

30 oral communications in conferences with personal invitation

37 oral communications in seminars or workshops with personal invitation

Teaching

2023 – 2024 **Optimal control, lectures and exercises (28h)** *MSc 2 CSMI, Université de Strasbourg*

Optimisation, lectures and exercises (28h) *MSc 1 CSMI, Université de Strasbourg*

Uncertainty quantification, lectures and exercises (8h) *MSc 2 CSMI, Université de Strasbourg*

Scientific computing, lectures and exercises (10h) *MSc 2, agrégation preparation, Université de Strasbourg*

2022 – 2023 **Uncertainty quantification (17h), scientific computing (16h), numerical analysis techniques 2 (10h)** *Université de Strasbourg*

2021 – 2022 **Uncertainty quantification (17h), numerical analysis techniques 1 (17h) and 2 (10h)** *Université de Strasbourg*

2020 – 2021 **Uncertainty quantification (17h), computer science (34h), numerical analysis techniques 1 (17h) and 2 (10h)** *Université de Strasbourg*

2011 – 2016 **Algebra, analysis, mathematics, numerical methods, approximation and signals, optimisation and linear programming** *Université de Franche-Comté and ISIFC engineering school*
From BSc 1 to MSc 1, lectures, exercise classes and computer labs.

IT and languages

IT **Python, Maple, Matlab, Scilab, FEniCS**

Languages **French (mother tongue), English and German (good level)**