Marius TUCSNAK
Chair Professor of Mathematics

Université de Bordeaux
Institut de Mathématiques de Bordeaux
351 cours de la Libération
F 33 405 Talence, France
☎ *+33629719539*
✉ *marius.tucsnak@u-bordeaux.fr*
https://www.math.u-bordeaux.fr/~mtucsnak/

CURRICULUM VITAE

- **EDUCATION**

1995	: Habilitation from the University of Paris 6
1990 -- 1992	: PhD from the University of Orléans, France
1980 -- 1985	: Master in Mathematics from the University of Bucharest, Romania.

- **CURRENT POSITION**

2015 –	: Chair professor of mathematics at University of Bordeaux, France

- **PREVIOUS POSITIONS**

1997 -- 2015	: Professor of mathematics at the University of Lorraine, Nancy, France
1992 -- 1997	: Assistant professor at University of Versailles, France
1987 -- 1992	: Research scientist at the Institute of Mathematics of the Romanian Academy
1985 -- 1987	: Research engineer at the Research Center for Textile Industry, Romania

- **HONOURS AND AWARDS**

2018 *The Spiru Haret Prize* of the Romanian Academy

2016 – 2019 Holder of the chair *Analysis and Control of Infinite Dimensional Dynamical Systems* of the Excellency Initiative of Université de Bordeaux

2013 – 2018 Member of the "Institut Universitaire de France" (IUF). According to Wikipedia, this institute *is a French service of the Ministry of Higher Education that distinguishes each year a small number of university professors for their research excellence, as evidenced by their international recognition. It was created to become a new "Collège de France", located in French universities. Only 2% of French university professors have been currently distinguished by the Institut Universitaire de France*.

- **INVITED PROFESSOR (for at least 1 month):**
  Universidad de Chile (2007), Imperial College, London (2008), Institute for applied Sciences, Bangalore, India (2008), BCAM, Bilbao, Spain (2011), Tel Aviv University, Israel, (2012), University of Wuhan, China, (2013), Institute of Mathematics and its Applications, Minneapolis, USA (2016), Northeast Normal University, Changchun, China (2019).

- **INVITED CONFERENCES AND LECTURES (a selection)**
  - International Conference of Theoretical and Numerical Fluid Mechanics, Vancouver, 2007
  - CEDYA'07 (National Spanish Conference on Differential Equations), Sevilla, Spain, 2007
  - International Conference on Control, Graz, Austria, 2011
  - Control of fluid-structure systems and inverse problems, Toulouse, France, 2012
  - Equadiff13, Prague, Czech Republic, 2013
  - International Workshop on Multiphase Flows, Tokyo, Japan, 2015

- CPDE (IFAC workshop), Bertinoro, Italy, 2016
- MTNS 2016, Minneapolis, USA, 2016
- Workshop on Numerical Methods for Optimal Control and Inverse Problems, Munich, Germany, 2017
- International Workshop on PDE-Constrained, Optimization, Optimal Controls and Applications, Sanya, China, 2018
- Stability and Control of Infinite-Dimensional Systems, Würzburg, Germany, 2018
- Control of Distributed Parameter Systems (CDPS), Oaxaca, Mexico, 2019
- Control and stabilization issues for PDE, Toulouse, France, 2019.

- **SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS**

Defended PhD Thesis:

Kais AMMARI, presently professor at University of Monastir (Tunisia):
« Stabilization of a class of equations of second order in time », defended on 07/01/2000.

Rogelio BENAVIDES, presently assistant professor in University of Belem (Brazil) :
« Stabilization by degenerated feedbacks », defended in June 2001.

Antoine CHAPELON, presently research engineer in IXSEA-OCEANO:
«Evolution Riccati Equations for infinite dimensional systems », defended in 2000.

Takéo TAKAHASHI, presently research scientist in INRIA Nancy Grand Est:
« Analysis of the equations modelling the motion of solids in viscous fluids », defended in December 2002.

Patricio CUMSILLE, presently assistant professor at University of Bio-Bio, Chile:
« Analysis of some fluid-structure interaction systems», defended in march 2006.

Jean Gabriel HOUOT, unknown situation :
« Modelling of the motion of solids in an ideal fluid », defended in June 2008.

Nicolae CINDEA, presently assistant professor at University Blaise Pascal from Clermont Ferrand :
« Control and inverse problems for evolution PDEs with applications in medicine », defended in April 2010.

Yuning LIU, presently assistant professor at NYU Shanghai, China:
« Analysis and control of some fluid-structure interaction problems », defended in November 2011.

Jerôme LOHEAC, presently CNRS research scientist at l'IRCYN, Nantes, France:
« Analysis and control of self-propelled low Reynolds motions », defended in November 2012.

Ghislaine HAINE, presently associated professor at SUPAERO, Toulouse :
« Observers for infinite dimensional systems and their applications », defended in June 2012.

Chi-Ting Wu, University of Lorraine, Nancy:
« Perturbations and approximations for time optimal control problems for parabolic systems », defence possibly in 2017 (scientific work finished but health problems impeached the defence for now).

Nicolas Hegoburu, University of Bordeaux :
« Control and identification in population dynamics », defended in May 2019.

Postdocs:

2010: V. Mikhaylov, presently assistant professor in St. Petersburg, Russia: *Inverse problems for the Schrödinger equation*

2013: J. Lequeurre, presently assistant professor in University of Lorraine, France: *Motion of a piston in a compressible fluid.*

2015-2018: Debayan Maity, *Interaction of solids with heat conducting gases, Control in population dynamics.*

2019- K. Le Balc'h, *Control of the Boussinesq equation*.

- **TEACHING ACTIVITIES**

Marius Tucsnak had continuous teaching activities since 1992 at all levels (undergraduate, graduate and postgraduate, doctoral and research courses). He is currently teaching the courses "Analysis and control for infinite dimensional systems" advanced course and "Introduction to control theory" graduate course in Université de Bordeaux. Moreover, he delivered advanced courses in the framework of summer schools held in Ravello (Italy), Prague (Czech Republic), Bangalore (India) and Tokyo (Japan).

- **ORGANISATION OF SCIENTIFIC MEETINGS (as main organizer)**

2005 Analysis and Control of fluid-structure interactions, Chile (40 participants),
2007 Analysis and Control of PDEs, Pont-à-Mousson, France (70 participants),
2013 Control of Distributed Parameter Systems, Craiova, Romania (80 participants).
2017 Control of Distributed Parameter Systems, Bordeaux, France (110 participants).
2018 14th French-Romanian Conference on Applied Mathematics, Bordeaux (115 participants)

- **INSTITUTIONAL RESPONSIBILITIES**

2017 - Director of the Excellency Cluster SysNum of the Bordeaux Excellency Initiative
2009 – 2015 Director of the Elie Cartan Institute (120 faculty members), Université de Lorraine, France
2001 – 2013 Head of the CORIDA Inria project team, Inria Nancy, France
2005 – 2009 Member of the Scientific Council of the Henri Poincaré University, Nancy, France
2002 – 2005 Member of the Inria Evaluation Committee.

- **COMMISSIONS OF TRUST**

2010 – 2016 Member of the evaluation panels for mathematics of the Universities of Toulouse, Montpellier, Grenoble (France) and Beijing Institute of Technology (China).
2011 – 2015 Member of the French National Council of Universities, section 26 (applied mathematics)
2010 – 2016 Evaluator of grant proposals for ANR (France), NSF (USA), CONICYT (Chile), NWO (Netherlands), CCSIS (Romania).

- **EDITORIAL BOARDS**

2015 -- SIAM Journal on Control and Optimization.
2015 -- Mathematical Control and Related Fields (MCRF)
2014 -- Mathematics of Control, Signals and Systems (MCSS)
2013 -- Journal of Mathematical Fluid Mechanics
2012 -- Revue Roumaine de Mathématiques Pure et Appliquées
2012 -- Mathematical Reports (Romania)
2005 --2015 ESAIM COCV (Associate Editor)
2015 -- ESAIM COCV (Corresponding Editor)

2003 – 2009 SIAM Journal on Control and Optimization.

- **MEMBERSHIPS OF SCIENTIFIC SOCIETIES:** SMAI, SIAM.

- **MAJOR COLLABORATIONS**

    - George Weiss, Tel Aviv (Israel) : infinite dimensional systems theory
    - Jorge San Marin, Santiago de Chile : fluid-structure interactions
    - Takéo Takahashi, Inria Nancy (France) : fluid-structure interactions and control theory
    - Sorin Micu, Craiova (Romania) : controllability of PDE systems.

- **Scientific Impact.**

My work in the last two decades has been focused on two subjects: controllability and identifiability for infinite dimensional dynamical systems on one side and the analysis and control of fluid structure interactions on the other side. The overall impact of my contributions to these fields (the h-index, according to google scholar, is 34) is reinforced by the invited lectures I gave in several major conferences and workshops, namely recently “IFAC Control of Partial Differential Equations”, Bertinoro, Italy and “Mathematical Theory of Network and Systems”, Minneapolis, USA. More specifically, an important part of the achievements on infinite dimensional systems are summarized in the book **B1**, with George Weiss, *Observation and Control for Operator Semigroups* (861 quotations on google scholar). Some relevant contributions to this field not included in this book concern sharp estimates on the reachable space of the boundary controlled heat equation (see reference **C01** below), on the cost of fast and strongly localized controls (reference **C39** below) and the new perspective of the connections between identification and control problems provided in references **C33** and **C37** below. More recently I have been considering a new class of control problems involving population dynamics models with age structure (**C02**, **C03**, **C07**).
On the other hand, among my early contributions to the analysis and the control of fluid-structure interactions, those in **C51** (with J.A. San Martín and V. Starovoitov), published in 2002 in ARMA, had a considerable impact (226 quotations on google scholar). The main contribution in this work is providing the first global in time existence (with possible impacts) of weak solutions for the system modelling the motion of rigid bodies in a viscous incompressible fluid. Among the other contributions, a special role is played by **C38**, which brings in rigorous tools of modern analysis in the study of mathematical models for fish-like swimming. A new idea proposed in a series of works consists in considering swimming, namely at low Reynolds numbers, as a control problem and in applying tools from controllability and optimal control theory in this context. An important part of my contributions to the analysis and the control of fluid-structure interactions are reported in the book chapter **B1**. We also think that a significant contribution to the controllability of fluid-structure interactions appears in **C23** and it is developed in **C16**. More precisely, the method employed in these works to establish a local null-controllability for some nonlinear problems turns out to be of much larger interest and it opened the way to new applications or to strong simplifications of some existing proofs. My most recent contribution to fluid-structure interaction problems is **C04**, where the main novelty is that the solids are supposed to float on the free surface of a fluid (instead of considering immersed solids as in most of the existing mathematical literature).

PUBLICATIONS

A. Monographs :

A1. M. Tucsnak and G. Weiss, *Observation and Control for Operator Semigroups*, 494 pages, Birkhäuser, Basel-Boston-Berlin, 2009.

B. Book Chapters :

B1. D. Maity and M. Tucsnak, A maximal regularity approach to the analysis of some particulate flows, in *Particles in flows* (edited by T. Bodnár, G. P. Galdi and Š. Nečasová), 1–75, Adv. Math. Fluid Mech., Birkhäuser/Springer, Cham, 2017

B2. J. San Martin and M. Tucsnak, Mathematical analysis of particulate flows, in *Trends in Fluid-Structure Interaction* (edited by G.P. Galdi and R. Rannacher), pp. 201--260, World Scientific, Singapore, 2010.

C. Articles published or accepted international journals :

C01. A. Hartmann, K. Kellay and M. Tucsnak, From the reachable space of the heat equation to Hilbert spaces of holomorphic functions, *Journal of the European Mathematical Society (JEMS),* 22 (2020), 3417-3440

C02. D. Maity, M Tucsnak and E. Zuazua, Controllability of a Class of Infinite Dimensional Systems with Age Structure, *Control and Cybernetics,* 2020.

C03. P. Su, M. Tucsnak, and G. Weiss, Stabilizability properties of a linearized water waves system, Systems & Control Letters 139 (2020): 104672.

C04. D. Maity, M Tucsnak and E. Zuazua, Controllability and positivity constraints in population dynamics with age structuring and diffusion, *Journal de Mathématiques Pures et Appliquées* 129 (2019), 153-179.

C05. D. Maity, J. San Martin, T. Takahashi and M Tucsnak, Analysis of a Simplified Model of Rigid Structure Floating in a Viscous Fluid, *J. Nonlinear Sci.* 29 (2019), 1975–2020

C06. M. Tucsnak, J. Valein and C.-T. Wu, Finite dimensional approximations for a class of infinite dimensional time optimal control problems, *International Journal on Control* 92 (2019), 132-144.

C07. B.H. Haak, D Maity, T. Takahashi and M. Tucsnak, Mathematical Analysis of the Motion of a Rigid Body in a Compressible Navier-Stokes-Fourier Fluid, *Matematische Nachrichten* 292 (2019), 1972-2017.

C08. N. Hegoburu and M. Tucsnak, Null controllability of the Lotka-McKendrick system with spatial diffusion, to appear in *Mathematical Control and Related Fields* 8 (2018), 705-720.

C09. N.Hegoburu, P. Magal and M. Tucsnak, Controllability with positivity constraints of the Lotka-McKendrick system, *SIAM J. Control Optim.* 56 (2018), 723–750.

C10. E. Feireisl, V. Mácha, S. Nečasová and M. Tucsnak, Analysis of the adiabatic piston problem via methods of continuum mechanics, *Ann. Inst. H. Poincaré Anal. Non Linéaire 35* (2018), 1377–1408.

C11. S.W. Hansen and M Tucsnak, Some new applications of Russell's principle to infinite dimensional vibrating systems, *Annual Reviews in Control* 44 (2017), 184-198.

C12. D. Maity, T. Takahashi and M. Tucsnak, Analysis of a system modelling the motion of a piston in a viscous gas, to appear in *Journal of Mathematical Fluid Dynamics*, 19 (2017), 551-579 .

C13. G. Wang, M. Tucsnak and C.-T. Wu, Perturbations of time optimal control problems for a class of abstract parabolic systems, *SIAM Journal on Control and Optimization*, 54 (2016), 2965–2991.

C14. K. Ramdani, M. Tucsnak and J. Valein, Detectability and state estimation for linear age-structured population diffusion models, *ESAIM: M2AN,* 50 (2016), 1731–1761

C15. T. Takahashi, M. Tucsnak and G. Weiss, Stabilization of a fluid-rigid body system, *J. Differential Equations,* 259 (2015), 6459–6493.

C16. J. San Martin, T. Takahashi and M. Tucsnak, An optimal control approach to ciliary locomotion, *Mathematical Control and related fields*, 6 (2016), 293–334.

C17. N. Cındea, S. Micu, I. Roventa and M. Tucsnak, Particle supported control of a fluid-particle system, *Journal de Mathématiques Pures et Appliquées,* 104 (2015), 311–353.

C18. M. Tucsnak and G. Weiss, From exact observability to identification of singular sources, *Mathematics of Control, Signals, and Systems*, 27 (2015), 1-21.

C19. M. Tucsnak and G. Weiss, Well-posed systems-The LTI case and beyond, *Automatica*, 50 (2014), 1757–1779.

C20. J. Daafouz, M. Tucsnak and J. Valein, Nonlinear control of a coupled PDE/ODE system modeling a switched power converter with a transmission line, *Systems Control Lett.*, 70 (2014), 92–99.

C21. J. Lohéac and M.Tucsnak, Maximum principle and bang-bang property of time optimal controls for Schrödinger-type systems, *SIAM J. Control Optim.*, 51 (2013), 4016–4038.

C22. M. Tucsnak, Weak stability of the solutions of a fluid-rigid body problem, *Ann. Univ. Buchar. Math. Ser.* 4, LXII (2013), 105–112.

C23. J. Lohéac, J.-F. Scheid and M. Tucsnak, Controllability and time optimal control for low Reynolds numbers swimmers, *Acta Appl. Math.*, 123 (2013), 175–200.

C24. Y. Liu, T. Takahashi and M. Tucsnak, Single input controllability of a simplified fluid-structure interaction model, *ESAIM COCV,* 19 (2013), 20-42.

C25. F. M. Hante, M. Sigalotti and M. Tucsnak, On conditions for asymptotic stability of dissipative infinite-dimensional systems with intermittent damping, *Journal of Differential Equations*, 252 (2012), 5569–5593.

C26. Y. Liu, T. Takahashi and M. Tucsnak, Strong solutions for a phase field Navier-Stokes vesicle-fluid interaction model, *Journal of Mathematical Fluid Mechanics*, 14 (2012), 25-49.

C27. S. Micu, I. Roventa and M. Tucsnak, Time optimal boundary controls for the heat equation. *J. Funct. Anal.*, 263 (2012), 25–49.

C28. G. Tenenbaum and M. Tucsnak, On the null-controllability of diffusion equations, *ESAIM COCV*, 17 (2011), 1088-1100.

C29. N. Cindea, S. Micu and M. Tucsnak, An approximation method for exact controls of vibrating systems, *SIAM Journal of Control and Optimization*, 49 (2011), 1283-1305.

C30. M. Gugat and M. Tucsnak, An example for the switching delay feedback stabilization of an infinite dimensional system: the boundary stabilization of a string, *Systems Control Letters*, 60 (2011), 226--233.

C31. S. Necasova, T. Takahashi and M. Tucsnak, Weak solutions for the motion of a self-propelled deformable structure in a viscous incompressible fluid, *Acta Aplicanda Mathematicae*, 116 (2011), 329–352.

C32. K. Ito, K. Ramdani and M. Tucsnak, A time reversal based algorithm for solving initial data inverse problems, *Discrete and Continuous Dynamical Systems, series S*, 4 (2011), 641-652.

C33. J. Houot, J. San Martin and M. Tucsnak, Existence of solutions for the equations modeling the motion of rigid bodies in an ideal fluid, *Journal of Functional Analysis*, 259 (2010), 2856-2885.

C34. K. Ramdani, M. Tucsnak and G. Weiss, Recovering the initial state of an infinite-dimensional system using observers, *Automatica*, 46 (2010), 1616-1625.

C35. N. Cindea and M. Tucsnak, Local exact controllability for Berger plate equation, *Math. Control Signals Systems*, 21 (2009), 93-110.

C36. M. Tucsnak and M. Vanninathan, Locally distributed control for the Helmholtz model of fluid-structure interaction, *Systems and Control Letters*, 58 (2009), 547-552.

C37. G. Tenenbaum and M. Tucsnak, Fast and strongly localized observation for the Schrödinger equation, *Transactions of the American Mathematical Society*, 361 (2009), 951-977.

C38. C. Alvez, A. Leonor Silvestre, T.Takahashi and M. Tucsnak, Solving inverse source problems using observability, *SIAM Journal of Control and Optimization*, 48 (2009), 1632-1659.

C39. J. San Martin, J.-F. Scheid, T. Takahashi and M. Tucsnak, An Initial and boundary value problem modeling of fish-like swimming, *Archive for Rational Mechanics and Analysis*, 188 (2008), 429-455.

C40. G. Tenenbaum and M. Tucsnak, New blow-up rates of fast controls for the Schrödinger and heat equations, *Journal of Differential Equations*, 243 (2007), 70-100.

C41. J. San Martin, T. Takahashi and M. Tucsnak, A control theoretic approach to the swimming of microscopic organisms, *Quarterly of Applied Mathematics*, 65 (2007), 405-424.

C42. K. Ramdani, T. Takahashi and M. Tucsnak, Uniformly exponentially stable approximations for a class of second order evolution equations, *ESAIM COCV*, 13 (2007), 503-527.

C43. K. Ramdani, T. Takahashi and M. Tucsnak, Internal stabilization of the plate equation in a square: the continuous and the semi-discretized problems, *Journal de Mathématiques Pures et Appliquées*, 85 (2006), 17-37.

C44. P. Cumsille and M. Tucsnak, Wellposedness for the Navier-Stokes flow in the exterior of a rotating obstacle, *Mathematical Methods in the Applied Sciences*, 29 (2006), 595-623.

C45. J. San Martin, J.-F. Scheid, T. Takahashi and M. Tucsnak, Convergence of the Lagrange-Galerkin method for the Equations Modeling the Motion of a Fluid-Rigid System, *SIAM J. on Numerical Analysis*, 43 (2005), 1536-1571.

C46. S. Micu et M. Tucsnak, Approximate controllability of a semi-discrete 1-D wave equation, *An. Univ. Craiova Ser. Mat. Inform.*, 32 (2005), 48-58.

C47. K. Ramdani, T. Takahashi, G. Tenenbaum and M. Tucsnak, A spectral approach for the exact observability of infnite-dimensional systems with skew-adjoint generator, *Journal of Functional Analysis*, 226 (2005), 193-229.

C48. T. Takahashi and M. Tucsnak, Global strong solutions for the two-dimensional motion of an infinite cylinder in a viscous fluid, *J. of Math. Fluid Mechanics*, 6 (2004), 53-77.

C49. R. Benavides Guzman and M. Tucsnak, Energy decay estimates for the damped plate equation with a local degenerated dissipation, *Systems and Control Letters*, 48 (2003), 191-197.

C50. G. Weiss and M. Tucsnak, How to get a conservative linear system out of thin air; part I, *ESAIM COCV*, 9 (2003), 247-274.

C51. M. Tucsnak and G. Weiss, How to get a conservative linear system out of thin air; part II, *SIAM Journal on Control*, 42 (2003), 907-935.

C52. J. San Martin, V. Starovoitov and M. Tucsnak, Global weak solutions for the two dimensional motion of several rigid bodies in an incompressible viscous fluid, *Archive for Rational Mechanics and Analysis*, 161 (2002), 113-147.

C53. K. Ammari, Z. Liu and M. Tucsnak, Decay rates for a beam with pointwise force and moment feedback, *Mathematics of Control, Signals, and Systems*, 15 (2002), 177-201.

C54. G. Weiss, O. Staffans and M. Tucsnak, Well-posed linear systems -a survey with emphasis on conservative systems, *Applied mathematics and computer science*, 11 (2001), 101-127

C55. S. Avdonin and M. Tucsnak, Simultaneous controllability in sharp time for two elastic strings, *ESAIM COCV*, 6 (2001), 259-274.

C56. K. Ammari, A.Henrot and M. Tucsnak, Asymptotic behavior of solutions and optimal location of the actuator for the pointwise stabilization of a string, *Asymptotic Analysis*, 28 (2001), 215-240.

C57. K. Ammari and M. Tucsnak, On the stabilization of a class of second order equations, *ESAIM COCV*, 6 (2001), 361-386.

C58. K. Ammari and M. Tucsnak, Pointwise stabilization of a Bernoulli-Euler beam by means of a force feedback, *SIAM J. Control Optim.*, 39 (2000), 1160-1181.

C59. C. Conca, J. San Martin and M. Tucsnak, Weak solutions of the equations modeling the motion of a rigid body in a viscous fluid, *Comm. Partial Differential Equations*, 25 (2000), 1019-1042.

C60. M. Tucsnak and G. Weiss, Simultaneous controllability and some applications, *SIAM J. Control Optim.*, 38 (2000), 1408-1427.

C61. S. Jaffard, M. Tucsnak and E. Zuazua, Singular internal stabilization of the wave equation, *Journal of Differential Equations*, 145 (1998), 184-215.

C62. S.Jaffard, M. Tucsnak and E. Zuazua, On a theorem of Ingham, *J. Fourier Anal. Appl.*, 3 (1997), 577-582.

C63. S.Jaffard and M. Tucsnak, Regularity of plate equations with control concentrated in interior curves, *Proc. Roy. Soc. Edinburgh Sect. A*, 127 (1997), 1005-1025.

C64. D. Tataru and M. Tucsnak, On the Cauchy problem for the full von Kármán system, *Nonlinear Differential Equations Appl.*, 4 (1997), no.3, 325-340.

C65. J.P. Puel and M. Tucsnak, Global existence for the full von Karman system, *Applied Mathematics and Optimization*, 34 (1996), 139-160.

C66. M. Tucsnak, Semi-internal stabilization for a nonlinear Bernoulli-Euler equation, *Mathematical Methods in the Applied Sciences*, 19 (1996), 897-907.

C67. M. Tucsnak, Regularity and exact controllability for a beam with piezoelectric actuator, *SIAM J. Control Optim.*, 34 (1996), 922-930.

C68. M. Tucsnak, Control of plate vibrations by means of piezoelectric actuators, *Discrete and Continuous Dynamical Systems*, 2 (1996), 281-293.

C69. J.P. Puel and M. Tucsnak, Boundary stabilization of the von Kármàn equations, *SIAM Journal on Control*, 33 (1995), 255-273.

C70. M. Tucsnak, Boundary stabilization for the streched string equation, *Differential and Integral Equations*, 6 (1993), 925-935.

C71. M. Tucsnak, Régularité frontière pour les équations de von Kármàn, *Annales de Sciences Mathématiques du Québec*, 16 (1992), 211-219.

C72. M.Tucsnak, Global existence and uniqueness for a class of quasilinear hyperbolic equations, *Rivista di Matematica Pura ed Aplicata*, 10 (1992), 25-38.

C73. M. Tucsnak, Exact controllability for a beam subjected to a variable end thrust, *Bollettino U.M.I.,* 5-A (1991), 215-221.

C74. On an initial and boundary value problem for the nonlinear Timoshenko beam, *An.Acad.Bras.Ci.*, 63 (1991), 115-125.

C75. M. Tucsnak, Buckling of nonlinearly elastic rods immersed in a fluid, *Bull. Math. de la Soc. Sci. Math. De Roumanie*, 34 (1989), 173-181.

C76. G.Sebe and M. Tucsnak, Spatial buckled states for immersed rods, *Int. J. Engng. Sci.*, 27 (1989), 503-513.

C77. I.R. Ionescu and M. Tucsnak, A singular perturbation problem for the heat equation in two phases media, *Rev. Roumaine de Math. Pures et Appl.*, 34 (1989), 537-544.

C78. G.Sebe and M. Tucsnak, The influence of a perfect fluid on the critical loading of a rod immersed in it, *Bull.Math. de la Soc.Sci.Math.de Roumanie,* 33 (1988), 355-361.

C79. C. Popescu, E. Segal, M. Tucsnak and C. Oprea, On the temperature integral in nonisothermal kinetics with linear heating rate, *Termochimica Acta*, 107 (1986), 365-370.

C80 C. Popescu, E. Segal, M. Tucsnak and C. Oprea, The temperature integral, *Termochimica Acta*, 121, (1987), 487-489.

C81. M. Tucsnak, The displacement boundary value problem in the statistical theory of composite materials, *Rev. Roum. Sci. Techn. -Mec. Appl.*, 31 (1986), 539-548.

C82. M. Tucsnak, A new proof of Cauchy's theorem, *Studii si Cercetari de Mecanica Aplicata,* 43 (1984), 279-282.

D. Proceedings articles:

D1. D. Maity and M. Tucsnak; Lp-Lq maximal regularity for some operators associated with linearized incompressible fluid-rigid body problems Selected Recent Results, in *Mathematical analysis in fluid mechanics—selected recent results,* 175–201, Contemp. Math., 710, Amer. Math. Soc., Providence, RI, 2018.

D2. N. Cîndea and M. Tucsnak, Local exact controllability for the Berger equation, in *Control and optimization of partial differential equations*, 73-83, Internat. Ser. Numer. Math., Birkhaüser, vol. 158, Basel, 2009.

D3. K. Ammari, G. Tenenbaum et M. Tucsnak, A sharp geometric condition for the boundary exponential stabilizability of a square plate by moment feedbacks only, in *Control of Coupled Partial Differential Equations*, 1-11, Internat. Ser. Numer. Math., Vol. 155, Birkhäuser, Basel, 2007.

D4. K. Ramdani, T. Takahashi et M. Tucsnak, A uniformly stable finite difference space semi-discretization for the internal stabilization of the plate equation in a square, in *Numerical Mathematics and Advanced Applications*, 1068-1076, Springer, Berlin, 2006.

D5. M. Tucsnak and G. Weiss, Well-posedness and exact controllability of coupled boundary control systems, in *Proceeedings of the UKACC Conference*, Cambridge, 2000;

D6. M. Tucsnak, Exact controllability for a hyperbolic equation with time dependent coefficients, in *Differential Equations and Control theory (Iasi, 1990)*, 335-341, Pitman Res. Notes Math. Ser, 250, Longman Sci. Tech., Harlow, 1991.

D7. M. Tucsnak, On the pointwise stabilization of a string, in *Control and Estimation of Distributed Parameter Systems (Vorau 1996)*, 287-295, International Series of Numerical Mathematics, Vol. 126, Basel, 1998.

E. Notes at *Comptes Rendues de l'Académie de Sciences* :

E1. J. San Martin, J.-F Scheid, T. Takahashi and M. Tucsnak, Convergence of the Lagrange-Galerkin method for a fluid-rigid system, *C. R. Math. Acad. Sci. Paris* 339 (2004), 59–64.

E2. K. Ammari, A. Henrot and M. Tucsnak, Optimal location of the actuator for the pointwise stabilization of a string, *C. R. Acad. Sci. Paris Sér. I Math.,* 330 (2000), 275–280.

E3. C. Conca, J. San Martin and M. Tucsnak, Motion of a rigid body in a viscous fluid, *C. R. Acad. Sci. Paris Sér. I Math.*, 328 (1999), 473–478.

E4. M. Tucsnak, Contrôle d'une poutre avec actionneur piézoélectrique, *C. R. Acad. Sci. Paris Sér. I Math.,* 319 (1994), 697–702.

E5. J.P. Puel and M. Tucsnak, Existence globale de solutions fortes pour le système complet des équations de von Kármán dynamiques, *C. R. Acad. Sci. Paris Sér. I Math.*, 318 (1994), 449–454

E6. J.P. Puel and M. Tucsnak, Stabilisation frontière pour les équations de von Kármán, *C. R. Acad. Sci. Paris Sér. I Math.,* 314 (1992), 609–612.

Description of 5 Key Publications

1. M. Tucsnak and G. Weiss, *Observation and Control for Operator Semigroups*, 494 pages, Birkhäuser, Basel-Boston-Berlin, 2009.

The concepts of controllability and of observability have been set at the center of control theory by the work of R. Kalman in the 1960's and soon they have been generalized to the infinite-dimensional context. Among the early contributors we mention D.L. Russell, H. Fattorini, T. Seidman, A.V. Balakrishnan, R. Triggiani, W. Littman and J.-L. Lions. The latter gave the field an enormous impact with his book published in 1987, which is still a main source of inspiration for many researchers. The book, meant to be a self-contained introduction into a relatively recent subject which is of interest for a large class of mathematicians and control engineers, assumes no prior knowledge of finite-dimensional control theory, and no prior knowledge of operator semigroups or of unbounded operators. We introduce, with complete proofs, everything needed from these areas. The authors have been motivated, in particular, by the remark that researchers in the area of observability and controllability of infinite dimensional systems tend to adopt a view point belonging either the abstract functional analysis school (operator theory) or to the partial differential equations school. By their collaboration they successfully combined these two approaches. Such collaboration is essential for an efficient approach to the subject. More precisely, the functional analytic methods are important to formulate in a precise way the main concepts and to investigate their interconnections. When we try to apply these concepts and results to systems governed by PDEs, one generally has to face new difficulties. To solve these difficulties, quite refined techniques of mathematical analysis might be necessary. This book presents in detail tools such as the method of multipliers, Carleman estimates and non-harmonic Fourier analysis. The authors obtain in this way a unified and detailed presentation of the existing results of exact or null controllability for hyperbolic, dispersive or parabolic partial differential equations. The authors present for the first time in book form recent results such as Hautus tests in infinite space dimensions or the boundary exact observability of Schrödinger or plate equations in rectangular domains, with arbitrarily small observation regions. Moreover, the book contains several new results such as the characterization of the reachable space of an exactly controllable system by means of a smooth input or generalizations and new applications of the simultaneous controllability results from authors' previous work. These results allow, in particular, obtaining in a simple way the observability of some systems from the corresponding properties of related equations (such as going from the wave equation to the Schrödinger equation).

2. J. San Martin, V. Starovoitov and M. Tucsnak, Global weak solutions for the two dimensional motion of several rigid bodies in an incompressible viscous fluid, *Archive for Rational Mechanics and Analysis*, 161 (2002), 113-147.

Modeling and analyzing the motion of rigid bodies in an incompressible fluid is a problem which has been interesting scientists for a long time. In the case of an ideal fluid, the first works on this subject go back to Kirchhoff and Kelvin. For a viscous fluid, mathematicians tackled the corresponding analytic issues only much later. The pioneering work of Serre considers the situation of a single body surrounded by a fluid filling the remaining part of the space. In this case, a simple change of variables allows working in a fixed given geometry. In the situation of several bodies moving in a bounded fluid the main difficulty to be tackled consists in the fact that we have an evolution free boundary value problem: the domain filled by the fluid changes in time and this change is one of the unknowns of the problem. The paper presented here is one of the first contributions to this emerging research direction. More precisely, the authors consider the two-dimensional motion of several non-homogeneous rigid bodies immersed in an incompressible non-homogeneous viscous fluid. The main novelty here is the proof of the global existence of weak solutions for this problem. The global character of the obtained solutions comes from the fact that the possible collisions between several rigid bodies or between a rigid body and the boundary can occur only at zero relative velocity. Moreover, the authors give estimates of the velocity and of the acceleration of the bodies when their mutual distance or the distance to the boundary tends to zero. The method of proof is based on the approximation by a modified bi-fluid problem, in which the solid is, roughly speaking, replaced by a very viscous fluid. The fact that the obtained sequence of solutions converges to a solution of the original problem is established by using the DiPerna-Lions theory on transport equations. The paper presented here was the departure point of an important number of works investigating, in particular, the (lack of) contacts within the considered model and, more generally, it had a significant impact on the analysis of fluid-structure interactions (115 citations in MathSciNet and 241 citations in Google Scholar).

3. Y. Liu, T. Takahashi and M. Tucsnak, Single input controllability of a simplified fluid-structure interaction model, *ESAIM COCV,* 19 (2013), 20-42.

The initial motivation of this paper was to study the controllability of a simplified 1D fluid-structure model in which the control acts at only one end of the fluid-structure system. More precisely, we consider a free boundary problem modelling the motion of a mass point in a fluid, which is modeled by the viscous Burgers equation. In spite of its 1D character, this problem seems to be still resisting to the machinery based on the Carleman estimates for a linearized problem with variable coefficients. One of the main ideas here is to use a constant coefficients linearization which has been studied using spectral methods. The key contribution comes at this point, where the authors give a general result (for parabolic problems) allowing to obtain the null controllability in presence of a fast decaying source from the standard null controllability. The important feature of this method (presently called the Liu-Takahashi-Tucsnak source term method in the literature) is that it works independently of the method employed to establish the initial null controllability result (moment methods, local or global Carleman estimates,…). The final step to obtain the result for the nonlinear problem is, as usual, constructing an appropriate fixed point scheme. The methodology introduced in this paper should have an important impact in the years to come, namely in problems in which we have information only on constant coefficients linearizations.

4. E. Feireisl, V. Mácha, S. Nečasová and M. Tucsnak, Analysis of the adiabatic piston problem via methods of continuum mechanics, *Ann. Inst. H. Poincaré Anal. Non Linéaire* 35 (2018), 1377–1408.

The adiabatic piston problem raises open questions which are still fascinating statistical physicists and applied mathematicise (we just mention, Sinai, Lieb or Gruber as important contributors to this problem). The problem consists in studying the stability of properties of a system forms of a cylinder filled with a heat conducting gas, in which a perfectly insulating piston can move without friction. In spite of the fact that the piston is not conducting heat, the only stable equilibrium states which are detected experimentally seem to be those with the same temperature in the whole gas. Explaining this property by mathematical analysis methods still seems an open question. In the presented work, the authors study the problem via the methods of continuum mechanics. More specifically, the motion of the gas is described by means of the Navier–Stokes–Fourier system in one space dimension, coupled with Newton's second law governing the motion of the piston. The main results establish global in time existence of strong solutions and show that the system stabilizes to an equilibrium state for large time.

5. M. Tucsnak and G. Weiss, From exact observability to identification of singular sources, *Mathematics of Control, Signals, and Systems*, 27 (2015), 1-21.

This work is devoted to the reconstruction of source terms in systems governed by PDEs and more precisely to the case in which these sources are “singular” (Dirac masses or derivatives of Dirac masses, for instance). By duality, the question is seen to be related to determining the reachable space of an exactly controllable linear system when the inputs are smooth (with respect to time) and they satisfy appropriate compatibility conditions. Strangely enough, this very basic questions was not at that time tackled in an abstract setting, although several results were available for particular systems of PDEs (like the wave equation). The main contribution of this paper is to give a complete description of the reachable space in an abstract setting and to successfully apply it to identification purposes. The authors obtain, in particular, the identifiability of point sources for the wave equation using an observation condition which satisfies the geometric optics condition or the identifiability of a point source for a rectangular plate using measures on an arbitrarily small part of the boundary.

6. A. Hartmann, K. Kellay and M. Tucsnak, From the reachable space of the heat equation to Hilbert spaces of holomorphic functions, *Journal of the European Mathematical Society (JEMS),* 22 (2020), 3417-3440.

This work considers one of the oldest and more important problems in control theory, concerning the reachable space of systems described by the heat equation on and interval with boundary controls. The main results assert that this space is generally sandwiched between two Hilbert spaces of holomorphic functions defined on a square in the complex plane and which has the initial segment as one of the diagonals. More precisely, in the case of Dirichlet boundary controls acting at both ends we prove that the reachable space contains the Hardy–Smirnov space and is contained in the Bergman space associated to the square. The employed methodology: is a breakthrough with respect to the existing literature: the authors first represent the input-to-state map as an integral operator whose kernel is a sum of Gaussians and then they study the range of this operator by combining the theory of Riesz bases for Hardy–Smirnov spaces in polygons and a result of Aikawa, Hayashi and Saitoh on the range of integral transforms associated with the heat kernel. This paper clearly opens new perspectives, namely towards a new maximum principle for time optimal controls for parabolic equations or for establishing local controllability results for quasilinear parabolic systems.