

## Part A. PERSONAL INFORMATION

CV date 2019-08-09

First and Family name	Enrique Fernandez-Cara		
Social Security, Passport, ID number		Age	62, Born on 1957-01-05
Researcher numbers	Researcher ID	L-2390-2014	
	Orcid code	0000-0001-6293-9249	

### A.1. Current position

Name of University/Institution	University of Sevilla		
Department	EDAN (Ecuaciones Diferenciales y Análisis Numérico)		
Address and Country	Facultad de Matemáticas, Tarfia s/n, 41012 Sevilla, SPAIN		
Phone number	+34954557992	E-mail cara@us.es	
Current position	Professor	From	July 1986
Espec. cód. UNESCO	1202.20, 1206.13, 2204		
Palabras clave	Theoretical analysis of PDEs, Numerical analysis of PDEs, Navier-Stokes equations, Control of PDEs		

### A.2. Education

PhD	University	Year
Mathematics	Sevilla, SPAIN	1981
Mathematics	Paris 6 (P. et M. Curie), FRANCE	1981

### A.3. JCR articles, h Index, thesis supervised... Global bibliometrics (August 9th, 2019):

Mathscinet: 157 contributions, 1459 citations (by 745 authors), h-index = 17

Scopus: 121 contributions, 1606 citations, h-index = 19

Google Scholar: 267 contributions, 3410 citations, h-index = 25

### Advisor of 25 PhD Theses in Spain and Brazil.

## Part B. CV SUMMARY (max. 3500 characters, including spaces)

*I have the Grade in Mathematics for the University of Sevilla (Spain) and the Doctorate in Mathematics for this University and also the University Paris 6 (France). I have been scholar, assistant professor, and full professor in the University of Sevilla. I have worked in Sevilla, Paris, Clermont-Ferrand and, more recently, as visiting professor, in several Brazilian universities: UNICAMP, UFF in Niterói and UFBB in Joao Pessoa. I have been the advisor of 25 PhD Theses and have participated in more than 20 Research Projects in Spain, France and Brazil. My main areas of interest are the theoretical and numerical analysis of PDEs, with special emphasis in nonlinear PDEs from Physics, Biology, etc. and control and optimization problems. I have published more than 150 papers in international journals and have attended more than 50 international conferences.*

## Part C. RELEVANT MERITS

### C.1. Publications (including books; last ten years):

2-s2.0-85056238658 Ashley, T., Carrizosa, E., Fernández-Cara, E. Heliostat field cleaning scheduling for Solar Power Tower plants: A heuristic approach (2019) Applied Energy, pp. 653-660.

MR3902884 Carvalho, Pitágoras P.; Fernández-Cara, Enrique. On the computation of Nash and Pareto equilibria for some bi-objective control problems. J. Sci. Comput. 78 (2019), no. 1, 246--273.

MR3859289 Fernández-Cara, Enrique; Maestre, Faustino. An inverse problem in elastography involving Lamé systems. J. Inverse Ill-Posed Probl. 26 (2018), no. 5, 589--605.

MR3857870 de Carvalho, Pitágoras Pinheiro; Fernández-Cara, Enrique. Weak-renormalized solutions for a simplified k-ε model of turbulence. Differential Integral Equations 31 (2018), no. 11-12, 893--908.

MR3854362 Araruna, F. D.; Calsavara, B. M. R.; Fernández-Cara, E. Local exact controllability of two-phase field solidification systems with few controls. Appl. Math. Optim. 78 (2018), no. 2, 267--296.

MR3849151 Araruna, F. D.; Araújo, B. S. V.; Fernández-Cara, E. Stackelberg-Nash null controllability for some linear and semilinear degenerate parabolic equations. Math. Control Signals Systems 30 (2018), no. 3, Art. 14.

- MR3818372 Araruna, Fágner Dias; Fernández-Cara, Enrique; da Silva, Luciano Cipriano. Hierarchic control for the wave equation. *J. Optim. Theory Appl.* 178 (2018), no. 1, 264--288.
- MR3810870 Fernández-Cara, Enrique; Limaco, Juan; Prouvé, Laurent. Optimal control of a two-equation model of radiotherapy. *Math. Control Relat. Fields* 8 (2018), no. 1, 117--133.
- MR3772848 Demarque, Reginaldo; Fernández-Cara, Enrique. Local null controllability of one-phase Stefan problems in 2D star-shaped domains. *J. Evol. Equ.* 18 (2018), no. 1, 245--261.
- MR3768001 Fernández-Cara, Enrique; Prouvé, Laurent. Optimal control of mathematical models for the radiotherapy of gliomas: the scalar case. *Comput. Appl. Math.* 37 (2018), no. 1, 745--762.
- 2-s2.0-85026447442 Ashley, T., Carrizosa, E., Fernández-Cara, E. Optimisation of aiming strategies in Solar Power Tower plants (2017) *Energy*, 137, pp. 285-291.
- 2-s2.0-85010619205 Carrizosa, E., Domínguez-Bravo, C.-A., Fernández-Cara, E., Quero, M. An optimization tool to design the field of a solar power tower plant allowing heliostats of different sizes (2017) *International Journal of Energy Research*, 41 (8), pp. 1096-1107.
- MR3745938 Fernández-Cara, E.; De Sousa, I.T.; Viera, F.B. Remarks concerning the approximate controllability of the 3D Navier-Stokes and Boussinesq systems. *SeMA J.* 74 (2017), no. 3, 237--253.
- MR3736685 Fernández-Cara, E.; De Sousa, I. T. Local null controllability of a free-boundary problem for the viscous Burgers equation. *SeMA J.* 74 (2017), no. 4, 411--427.
- MR3736163 Fernández-Cara, Enrique; Nina-Huamán, Dany; Nuñez-Chávez, Miguel R.; Vieira, Franciane B. On the theoretical and numerical control of a one-dimensional nonlinear parabolic partial differential equation. *J. Optim. Theory Appl.* 175 (2017), no. 3, 652--682.
- MR3692116 Cavalcanti, M. M.; Fernández-Cara, E.; Ferreira, A. L. Null controllability of some nonlinear degenerate 1D parabolic equations. *J. Franklin Inst.* 354 (2017), no. 14, 6405--6421.
- MR3654149 Fernández-Cara, Enrique; de Sousa, Ivaldo Tributino. Local null controllability of a free-boundary problem for the semilinear 1D heat equation. *Bull. Braz. Math. Soc. (N.S.)* 48 (2017), no. 2, 303--315.
- MR3652397 Araruna, F. D.; Fernández-Cara, E.; Guerrero, S.; Santos, M. C. New results on the Stackelberg-Nash exact control of linear parabolic equations. *Systems Control Lett.* 104 (2017), 78--85.
- MR3600910 Fernández-Cara, Enrique; Münch, Arnaud; Souza, Diego A. On the numerical controllability of the two-dimensional heat, Stokes and Navier-Stokes equations. *J. Sci. Comput.* 70 (2017), no. 2, 819--858.
- MR3570492 Fernández-Cara, E.; Limaco, J.; de Menezes, S.B. Controlling linear and semilinear systems formed by one elliptic and two parabolic PDEs with one scalar control. *ESAIM Control Optim. Calc. Var.* 22 (2016), no. 4, 1017--1039.
- MR3534468 Fernández-Cara, Enrique; Lü, Qi; Zuazua, Enrique. Null controllability of linear heat and wave equations with nonlocal spatial terms. *SIAM J. Control Optim.* 54 (2016), no. 4, 2009--2019.
- MR3437899 Fernández-Cara, E.; Santos, M.C.; Souza, D.A. Boundary controllability of incompressible Euler fluids with Boussinesq heat effects. *Math. Control Signals Systems* 28 (2016), no. 1, Art. 7, 28 pp.
- MR3433238 Fernández-Cara, E.; Limaco, J.; de Menezes, S.B. On the controllability of a free-boundary problem for the 1D heat equation. *Systems Control Lett.* 87 (2016), 29--35.
- 2-s2.0-84954401888 Carrizosa, E., Domínguez-Bravo, C., Fernández-Cara, E., Quero, M. Optimization of multiple receivers solar power tower systems (2015) *Energy*, 90, pp. 2085-2093.
- MR3412273 Fernández-Cara, E.; Limaco, J.; de Menezes, S. B. Theoretical and numerical local null controllability of a Ladyzhenskaya-Smagorinsky model of turbulence. *J. Math. Fluid Mech.* 17 (2015), no. 4, 669--698.
- MR3395760 Fernández-Cara, E.; González-Burgos, M.; de Teresa, L. Controllability of linear and semilinear non-diagonalizable parabolic systems. *ESAIM Control Optim. Calc. Var.* 21 (2015), no. 4, 1178--1204.
- MR3358632 Araruna, F. D.; Fernández-Cara, E.; Santos, M. C. Stackelberg-Nash exact controllability for linear and semilinear parabolic equations. *ESAIM Control Optim. Calc. Var.* 21 (2015), no. 3, 835--856.
- MR3356563 Fernández-Cara, Enrique; Doubova, Anna Some geometric inverse problems for the linear wave equation. *Inverse Probl. Imaging* 9 (2015), no. 2, 371-393.
- MR3306467 Carrizosa, E.; Domínguez-Bravo, C.; Fernández-Cara, E.; Quero, M. A heuristic method for simultaneous tower and pattern-free field optimization on solar power systems. *Comput. Oper. Res.* 57 (2015), 109-122.
- MR3270952 Fernández-Cara, Enrique; Santos, Mauricio C. Numerical null controllability of the 1D linear Schrödinger equation. *Systems Control Lett.* 73 (2014), 33-41.
- MR3264238 Araruna, Fágner D.; Fernández-Cara, Enrique; Souza, Diego A. Uniform local null control of the Leray- $\alpha$  model. *ESAIM Control Optim. Calc. Var.* 20 (2014), no. 4, 1181-1202.
- MR3260984 Fernández-Cara, Enrique; Münch, Arnaud. Numerical exact controllability of the 1D heat equation: duality and Carleman weights. *J. Optim. Theory Appl.* 163 (2014), no. 1, 253-285.
- MR3195356 Cabrales, Roberto C.; Camacho, Gema; Fernández-Cara, Enrique. Analysis and optimal control of some solidification processes. *Discrete Contin. Dyn. Syst.* 34 (2014), no. 10, 3985-4017.
- MR3182682 Cindea, Nicolae; Fernández-Cara, Enrique; Münch, Arnaud. Numerical controllability of the wave equation through primal methods and Carleman estimates. *ESAIM Control Optim. Calc. Var.* 19 (2013), no. 4, 1076-1108.
- MR3116282 Clark, H. R.; Fernández-Cara, E.; Limaco, J.; Medeiros, L. A. Theoretical and numerical local null controllability for a parabolic system with local and nonlocal nonlinearities. *Appl. Math. Comput.* 223 (2013), 483-505.

- MR3100056 Araruna, Fagner D.; Fernández-Cara, Enrique; Souza, Diego A. On the control of the Burgers-alpha model. *Adv. Differential Equations* 18 (2013), no. 9-10, 935-954.
- MR3062151 Fernández-Cara, Enrique; Münch, Arnaud. Strong convergent approximations of null controls for the 1D heat equation. *SeMA J.* 61 (2013), 49-78.
- MR3041629 Calzada, M. Carmen; Fernández-Cara, Enrique; Marín, Mercedes. Optimal control oriented to therapy for a free-boundary tumor growth model. *J. Theoret. Biol.* 325 (2013), 1-11.
- MR2991568 Fernández-Cara, Enrique; Münch, Arnaud. Numerical null controllability of semi-linear 1-D heat equations: fixed point, least squares and Newton methods. *Math. Control Relat. Fields* 2 (2012), no. 3, 217-246.
- MR2968937 Fernández-Cara, Enrique. Motivation, analysis and control of the variable density Navier-Stokes equations. *Discrete Contin. Dyn. Syst. Ser. S* 5 (2012), no. 6, 1021-1090.
- MR2948740 Fernández-Cara, Enrique; Maestre, Faustino. On some inverse problems arising in elastography. *Inverse Problems* 28 (2012), no. 8, 085001, 15 pp.
- MR2962822 Fernández-Cara, Enrique. The control of PDEs: some basic concepts, recent results and open problems. *Topics in mathematical modeling and analysis*, 49-107, Jindrich Necas Cent. Math. Model. Lect. Notes, 7, Matfyzpress, Prague, 2012.
- MR2914234 Reviewed Boldrini, J. L.; Doubova, A.; Fernández-Cara, E.; González-Burgos, M. Some controllability results for linear viscoelastic fluids. *SIAM J. Control Optim.* 50 (2012), no. 2, 900-924.
- MR2910334 Doubova, A.; Fernández-Cara, E. On the control of viscoelastic Jeffreys fluids. *Systems Control Lett.* 61 (2012), no. 4, 573-579.
- MR2878694 Fernández-Cara, Enrique; Limaco, Juan; de Menezes, Silvano B. Null controllability for a parabolic equation with nonlocal nonlinearities. *Systems Control Lett.* 61 (2012), no. 1, 107-111.
- MR2800621 Camacho, G.; Fernández-Cara, E. Optimal control of some simplified models of tumour growth. *Internat. J. Control* 84 (2011), no. 3, 540-550.
- MR2753365 Carmen Calzada, M.; Camacho, Gema; Fernández-Cara, Enrique; Marín, Mercedes. Fictitious domains and level sets for moving boundary problems. Applications to the numerical simulation of tumor growth. *J. Comput. Phys.* 230 (2011), no. 4, 1335-1358.
- MR2665408 Fernández-Cara, Enrique; González-Burgos, Manuel; de Teresa, Luz. Boundary controllability of parabolic coupled equations. *J. Funct. Anal.* 259 (2010), no. 7, 1720-1758.
- MR2642693 Fernández-Cara, Enrique. Remarks on the controllability of some parabolic equations and systems. *Applied and numerical partial differential equations*, 81-95, *Comput. Methods Appl. Sci.*, 15, Springer, New York, 2010.
- MR2578571 Boldrini, José Luiz; Caretta, Bianca Morelli Calsavara; Fernández-Cara, Enrique. Some optimal control problems for a two-phase field model of solidification. *Rev. Mat. Complut.* 23 (2010), no. 1, 49-75.

## C.1bis. Workshop and congress contributions (last five years):

Highlights:

Main Lecturer, 2011 Kacov School on Mathematical Fluid Mechanics (Kacov, Czech Republic);

Main Speaker, 2018 Joint Spain-Brazil Meeting in Mathematics (Cadiz, Spain)

Main Lecturer and Main Speaker, 2019 IFAC CPDE/CDPS Course-Conference (Oaxaca, México).

- New Optimal Control and Null Controllability Results for Navier-Stokes-like Systems, 3rd IFAC/IEEE CSS Workshop on Control of Systems Governed by Partial Differential Equations (CPDE) and XI Workshop Control of Distributed Parameter Systems (CDPS 2019), Oaxaca (México), May 2019.
- Some Positive and Negative Results on the Control of PDE, XI Summer Workshop in Mathematics, University of Brasilia (Brazil), Feb 2019.
- On Multi-Objective Control Problems in Fluid Mechanics, Workshop de Verão em EDPs e Sistemas Dinâmicos, Univ. Federal do Pernambuco, Recife (Brasil), Feb 2019.
- On the Control of the Navier-Stokes Equations and Related Systems, 2nd Joint Meeting Brazil-Spain in Mathematics, Cádiz (Spain), Dec 2018.
- Tres Problemas Abiertos y Tres Modestas Contribuciones sobre las Ecuaciones de Navier-Stokes, 51 Congreso Nacional de la Sociedad Matemática Mexicana, Villahermosa, Tabasco (México), Oct 2018.
- Aspectos Numéricos del Control de Ecuaciones en Derivadas Parciales, 51 Congreso Nacional de la Sociedad Matemática Mexicana, Sesión Especial: Análisis Numérico y Optimización, Villahermosa, Tabasco (México), Oct 2018.
- Some Recent Regularity and Controllability Results for the Navier-Stokes Equations, Coloquio de São João, Univ. Federal do Pernambuco, Recife (Brasil), Jun 2018.
- Some Control and Inverse Problems with Medical Applications, VII Workshop in Nonlinear PDE's and Geometric Analysis, Joao Pessoa (Brazil), Feb 2018.
- Theoretical and Numerical Stackelberg-Nash Control of some PDEs, Workshop "Optimal Control of PDEs", on the occasion of Eduardo Casas' 60th birthday, Castro Urdiales, Sep 2017.
- On the Navier-Stokes Equations: Three Major Open Problems and Three Modest Contributions, International Workshop on "Nonlinear Analysis and Differential Equations", a celebration of the 60th birthday of Antonio Cañada, Granada, Sep 2017.
- Theoretical and Numerical Hierarchical Controllability of some PDEs, Journées "Contrôle et Problèmes Inverses", Clermont-Ferrand (France), Sep 2017.

- Inverse Problems with Applications to Cancer Detection and Therapy and Other Fields, CEDYA 2017, Univ. Politécnica de Cartagena (Spain), Jun 2017.
- Some Control Problems with Origin in Radiotherapy, IV Congreso Conjunto RSME-SMM, Valladolid (Spain), Jun 2017.
- Some Multi-Objective Strategies in Control Theory, IV Symposium on Partial Differential Equations to celebrate the 60th birthday of Marcelo Cavalcanti, Maringá (Brazil), Nov 2016.
- Theoretical and Numerical Solution of some Control and Inverse Problems with Applications to Cancer Detection and Therapy, ENAMA 2016, Niteroi (Brazil), Nov 2016.
- On the Stackelberg Strategies in Control Theory, International Conference “Nonlinear Partial Differential Equations and Applications” in the honor of Jean-Michel Coron, for his 60th birthday, Paris (France), Jun 2016.
- Numerical Control and Inverse Problems and Carleman estimates, Numerical Resolution of Inverse Problems II, BCAM, Bilbao (Spain), Jan 2016.
- Three Results Concerning the Controllability of PDEs, CEDYA 2015, Special Session on Control of PDEs, Cádiz, Jun 2015.

## C.2. Research projects and grants

- Grant 3308, Universidad Complutense (SPAIN), C.A.I.C.Y.T., January 1984 to December 1986.- Proyectos de Investigación Hispano-Franceses en Métodos Numéricos, M.E.C. - M.R.T. (FRANCE), January 1986 to December 1987.
- Acciones Integradas Hispano-Francesas, Hispano-Italianas e Hispano-Marroquíes de Investigación, since January 1988 (Coordinator).
- Ayudas al Grupo de Investigación FQM 131 (former 70.17), Junta de Andalucía, since January 1989 (Coordinator).
- Grants PB92-0696, PB95-1242, PB98-1134, BFM2000-1317, BFM2003-06446, MTM2006-07932, MTM2010-15592, MTM2013-41286-P, MTM2016-76990-P of D.G.I.-D.G.E.S. (Govern of Spain), since June 1993 (Coordinator).
- Proyecto HFS2000 (Research Training Network), V Programa Marco (European Union), December 2000 to December 2004.
- European Group CONEDP, since January 2010, Resp. F. Alabau (Participant).
- Science without Frontiers Project, Univ. Federal de Paraíba (Joao Pessoa, Brazil), 2013--2015 (Main Visitor).
- Solar Eranet 2015 Project PCIN-2015-508, in collaboration with Univ. of Aachen (Governs of Spain and Germany), 2015--2018, Resp.: E. Carrizosa (Participant).
- Red de Excelencia MTM2015-70444-REDT (Govern of Spain), 2015--2017 (Coordinator).

## C.3. Contracts:

- Proyecto HERMES - Sevilla (RDANE 23/87), Agencia Espacial Europea (E.S.A.), April 1987 to May 1990 (Coordinator).
- Proyecto CapTorSol ABENGOA SOLAR – Universidad de Sevilla, June 2011 to May 2014 (Coordinator joint to E. Carrizosa).

## C.4. Patents:

## C.5. Institutional responsibilities:

- Vicedecano de la Facultad de Matemáticas de la Univ. de Sevilla. April 1988 to March 1989.
- Director del Departamento de Análisis Matemático de la Univ. de Sevilla. 1989--1992.
- Director del Departamento EDAN de la Univ. de Sevilla, April 1993 to March 2000, November 2004 to January 2009.

## C.6 Other merits and activities

- 6 six-year research periods (Sexenios).
- Referee of more than 50 JCR Publications.
- Past or present member of the Editorial Boards of SIAM J on Control and Optimization, ESAIM: Control, Optimisation and Calculus of Variations, Mathematical Control and Related Fields.
- Secretary of the Spanish Society of Applied Mathematics (SeMA) since October 1997 to September 1998. President of SeMA since October 1998 to October 2000 and Chief Editor of Bulletin SEMA and SeMA Journal, 1999--2013.
- Gestor (Chairman) del Programa Nacional de Matemáticas, June 2005 to November 2008.