

CURRICULUM VITAE

Vicente Novo

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1. Personal Data

Name: Vicente Novo Sanjurjo

Place of birth: Ribadeo, Lugo, Spain

Professional Address: Office no. 2.41, Departamento de Matemática Aplicada,
ETSI Industriales, UNED. c/ Juan del Rosal no. 12, 28040, Madrid, Spain

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2. Academic Degrees

1973 Bs.C. in Statistics, Universidad Complutense, Madrid

1973 Ms.C. in Mathematical Sciences, Universidad Complutense, Madrid

1990. Ph.D. in Mathematics, UNED, Madrid

3. Qualifications and Employment History

1973-1976 Professor, University San Pablo-CEU. Gave courses on Statistics and Mathematics for Economists

1976-1980 Assistant Professor, Department of Mathematics, UNED, Madrid.
Gave courses on Analysis

1981-1990 Associate Professor, Department of Applied Physics, UNED, Madrid. Gave courses on Differential Equations and Statistics

1990— Professor, Department of Applied Mathematics, UNED, Madrid. Gave courses on Probability and Statistics, Analysis, Algebra, Mathematical Programming and Optimization. For PhD students gave courses on Robust Statistics, Nonsmooth Analysis, and Multiobjective and Vector Optimization

Positive evaluation of seven periods of 5 years of teaching. UNED

4. Fields of Interest

Optimization and Applications. Mathematical Programming.

Multiobjective, Vector and Set-Valued Optimization.

Convex Analysis. Generalized Convexity and Generalized Monotonicity.

Nonsmooth Analysis. Generalized Derivatives.

5. Published Textbooks

1. Cálculo de Primitivas (Aplicaciones). Uned 1988, Madrid (with J.I. Alonso)
2. Métodos Estadísticos. Two editions 1989 and 1994, Uned, Madrid
3. Estadística Teórica y Aplicada. Four editions 1991, 1995, 2000 and 2001, Uned, Madrid
4. Estadística Teórica y Aplicada. Two editions 2004 and 2011, Ed. Sanz y Torres, Madrid
5. Problemas de Cálculo de Probabilidades y Estadística. Three editions 1993, 1999 and 2001, Uned, Madrid
6. Problemas de Cálculo de Probabilidades y Estadística. Two editions 2003 and 2011, Ed. Sanz y Torres, Madrid

7. Gestión y Control de Calidad. Eight editions 1994, 1997, 1998, 1999, 2002, 2005, 2005, 2009, Uned, Madrid (with M.A. Sebastián and V. Bargaño)
8. Teoría de la Optimización. Three editions 1997, 1999 and 2000, Uned, Madrid
9. Optimización. Casos Prácticos. Uned 2000, Madrid (with A. Díaz and J. Perán). Published as e-book in May 2013.
10. Ejercicios Resueltos de Fundamentos Matemáticos. Ingeniería en Tecnologías de la Información. Uned 2014, Madrid (with L. Huerga y B. Jiménez). Published as e-book in October 2014.

6. Publications (2001 →)

1. Partial and generalized subconvexity in vector optimization problems. Journal of Convex Analysis 8, 2 (2001), 583-594 (with M. Adán)
2. Optimality conditions for vector optimization problems with generalized convexity in real linear spaces. Optimization 51, 1 (2002), 73-91 (with M. Adán)
3. A finite dimensional extension of Lyusternik theorem with applications to multiobjective optimization. Journal of Mathematical Analysis and Applications 270, 2 (2002), 340-356 (with B. Jiménez)
4. Alternative theorems and necessary optimality conditions for directionally differentiable multiobjective programs. Journal of Convex Analysis 9, 1 (2002), 97-116 (with B. Jiménez)
5. First and second order sufficient conditions for strict minimality in multiobjective programming. Numerical Functional Analysis and Optimization, 23, 3-4 (2002), 303-322 (with B. Jiménez)

6. A notion of local proper efficiency in the Borwein sense in vector optimization. ANZIAM Journal 45, 1 (2003), 75-89 (with B. Jiménez)
7. Efficient and weak efficient points in vector optimization with generalized cone convexity. Applied Mathematics Letters 16, 2 (2003), 221-225 (with M. Adán)
8. Weak efficiency in vector optimization using a closure of algebraic type under cone-convexlikeness. European Journal of Operational Research 149, 3 (2003), 641-653. (with M. Adán)
9. Optimality conditions in directionally differentiable Pareto problems with a set constraint via tangent cones. Numerical Functional Analysis and Optimization 24, 5-6 (2003), 557-574 (with B. Jiménez)
10. Second order necessary conditions in set constrained differentiable vector optimization. Mathematical Methods of Operations Research 58, 2 (2003), 299-317 (with B. Jiménez)
11. First and second order sufficient conditions for strict minimality in non-smooth vector optimization. Journal of Mathematical Analysis and Applications 284 (2003), 496-510 (with B. Jiménez)
12. Minimum principle-type optimality conditions for Pareto problems. International Journal of Pure and Applied Mathematics 10, 1 (2004), 51-68 (with G. Giorgi and B. Jiménez)
13. Lagrange multipliers in multiobjective optimization under mixed assumptions of Fréchet and directional differentiability. Investigación Operacional 25, 1 (2004), 34-47 (with B. Jiménez)
14. Proper efficiency in vector optimization on real linear spaces. Journal of Optimization Theory and Applications 121, 3 (2004), 515-540 (with M.

- Adán)
- Errata Corrige: Proper efficiency in vector optimization on real linear spaces. *Journal of Optimization Theory and Applications* 124, 3 (2005), 751-751 (with M. Adán)
15. Optimality conditions in differentiable vector optimization via second-order tangent sets. *Applied Mathematics and Optimization* 49, 2 (2004), 123-144 (with B. Jiménez)
 16. On constraint qualifications in directionally differentiable multiobjective optimization problems. *RAIRO Operations Research* 38, 3 (2004), 255-274 (with G. Giorgi and B. Jiménez)
 17. A property of efficient and ε -efficient solutions in vector optimization. *Applied Mathematics Letters* 18, 4 (2005), 409-414 (with C. Gutiérrez and B. Jiménez)
 18. Multiplier rules and saddle point theorems for Helbig's approximate solutions in convex Pareto problems. *Journal of Global Optimization* 32, 3 (2005), 367-383 (with C. Gutiérrez and B. Jiménez)
 19. A chain rule for epsilon-subdifferentials with applications to approximate solutions in convex Pareto problems. *Journal of Mathematical Analysis and Applications* 310, 1 (2005), 309-327 (with C. Gutiérrez and B. Jiménez)
 20. Duality and saddle-points for convex-like vector optimization on real linear spaces. *TOP* 13, 2 (2005), 343-357 (with M. Adán)
 21. Benson proper efficiency in set-valued optimization on real linear spaces. In *Recent Advances in Optimization*, Edit. A. Seeger. *Lectures Notes in Economics and Mathematical Systems* 563, Springer 2006, 45-59 (with E. Hernández and B. Jiménez)

22. Conditions and parametric representations of approximate minimal elements of a set through scalarization. In Large Scale Nonlinear Optimization. G. Di Pillo, M. Roma eds. Nonconvex Optimization and its Applications 83, Springer 2006, 173-184. (with C. Gutiérrez and B. Jiménez)
23. ε -Pareto optimality conditions for convex multiobjective programming via Max function. Numerical Functional Analysis and Optimization 27, 1 (2006), 57-70 (with C. Gutiérrez and B. Jiménez)
24. On approximate efficiency in mathematical programming. Mathematical Methods of Operations Research 64, 1 (2006), 165-185 (with C. Gutiérrez and B. Jiménez)
25. On approximate solutions in vector optimization problems via scalarization. Computational Optimization and Applications 35, 3 (2006), 305-324 (with C. Gutiérrez and B. Jiménez)
26. A unified approach and optimality conditions for approximate solutions of vector optimization problems. SIAM Journal on Optimization 17, 3 (2006), 688-710 (with C. Gutiérrez and B. Jiménez)
27. Characterization of the cone of attainable directions. Journal of Optimization Theory and Applications 131, 3 (2006), 493-499 (with B. Jiménez)
28. El problema de optimización vectorial. Conceptos de optimalidad. Boletín de la SEIO 22, 4 (2006), 16-21
29. Sufficient optimality conditions and duality in nonsmooth multiobjective optimization problems under generalized convexity. In Generalized Convexity and Related Topics. I.V. Konnov, D.T. Luc and A.M. Rubinov eds., Lecture Notes in Economics and Mathematical Systems 583, Springer 2007, 265-278 (with G. Giorgi and B. Jiménez)

30. Optimality conditions for Tanaka's approximate solutions in vector optimization. In *Generalized Convexity and Related Topics*. I.V. Konnov, D.T. Luc and A.M. Rubinov eds., *Lecture Notes in Economics and Mathematical Systems* 583, Springer 2007, 279-295 (with C. Gutiérrez and B. Jiménez)
31. Weak and proper efficiency in set-valued optimization on real linear spaces. *Journal of Convex Analysis* 14, 2 (2007), 275-296 (with E. Hernández and B. Jiménez)
32. Optimality conditions for metrically consistent approximate solutions in vector optimization. *Journal of Optimization Theory and Applications* 133, 3 (2007), 49-64 (with C. Gutiérrez and B. Jiménez)
33. First order optimality conditions in vector optimization involving stable functions. *Optimization* 57, 3 (2008), 449-471 (with B. Jiménez)
34. Characterizing efficiency without linear structure: a unified approach. *Journal of Global Optimization* 41, 1 (2008), 43-60 (with F.Flores-Bazán and E. Hernández)
35. Higher-order optimality conditions for strict local minima. *Annals of Operations Research* 157, 1 (2008), 183-192 (with B. Jiménez)
36. A set-valued Ekeland's variational principle in vector optimization. *SIAM Journal on Control and Optimization* 47, 2 (2008), 883-903 (with C. Gutiérrez and B. Jiménez)
37. A note on first-order sufficient optimality conditions for Pareto problems. *Numerical Functional Analysis and Optimization* 29, 9-10 (2008), 1108-1113 (with G. Giorgi and B. Jiménez)
38. New second order directional derivative and optimality conditions in scalar and vector optimization. *Journal of Optimization Theory and Applications*

- 142, 1 (2009), 85-106 (with C. Gutiérrez and B. Jiménez)
39. Some applications of invexity and generalized invexity to Pareto optimization problems. *International Journal of Optimization: Theory, Methods and Applications* 1, 1 (2009), 1-14 (with G. Giorgi and B. Jiménez)
40. Scalarization and optimality conditions for strict minimizers in multiobjective optimization via contingent epiderivatives. *Journal of Mathematical Analysis and Applications* 352, 2 (2009), 788-798 (with B. Jiménez and M. Sama)
41. Strong Kuhn-Tucker conditions and constraint qualifications in locally Lipschitz multiobjective optimization problems. *TOP* 17, 2 (2009), 288-304 (with G. Giorgi and B. Jiménez)
42. Optimality conditions via scalarization for a new ε - efficiency concept in vector optimization problems. *European Journal of Operational Research* 201, 1 (2010), 11-22 (with C. Gutiérrez and B. Jiménez)
43. On second-order Fritz John type optimality conditions in nonsmooth multiobjective programming. *Mathematical Programming Serie B* 123, 1 (2010), 199-223 (with C. Gutiérrez and B. Jiménez)
44. Generalized ε -quasi solutions in multiobjective optimization problems: existence results and optimality conditions. *Nonlinear Analysis Series A: Theory, Methods and Applications* 72, 11 (2010), 4331-4346 (with C. Gutiérrez and R. López-Montoya)
45. Higher order strong convexity and global strict minimizers in multiobjective optimization. *Journal of Convex Analysis* 18, 1 (2011), 85-103 (with C. Gutiérrez and B. Jiménez)

46. An overview of second order tangent sets and their application in vector optimization. *Boletín de la Sociedad Española de Matemática Aplicada* 52 (2010), 73-96 (with G. Giorgi and B. Jiménez)
47. A generic approach to approximate efficiency and applications to vector optimization with set-valued maps. *Journal of Global Optimization* 49, 2 (2011), 313-342 (with C. Gutiérrez and B. Jiménez)
48. Strict approximate solutions in set-valued optimization with applications to the approximate Ekeland variational principle. *Nonlinear Analysis Series A: Theory, Methods and Applications* 73, 12 (2010), 3842-3855 (with C. Gutiérrez, B. Jiménez and L. Thibault)
49. A Brézis-Browder principle on partially ordered spaces and related ordering theorems. *Journal of Mathematical Analysis and Applications* 375, 1 (2011), 245-260 (with F. Flores-Bazán and C. Gutiérrez)
50. Equivalent ε -efficiency notions in vector optimization. *TOP* 20, 2 (2012), 437-455 (with C. Gutiérrez and B. Jiménez)
51. Pointwise well-posedness in set optimization with cone proper sets. *Nonlinear Analysis Series A: Theory, Methods and Applications* 75, 4 (2012), 1822-1833 (with C. Gutiérrez, E. Miglierina and E. Molho)
52. Scalarization and saddle points of approximate proper solutions in nearly subconvexlike vector optimization problems. *Journal of Mathematical Analysis and Applications* 389, 2 (2012), 1046-1058 (with C. Gutiérrez and L. Huerga)
53. Improvement sets and vector optimization. *European Journal of Operational Research* 223, 2 (2012), 304-311 (with C. Gutiérrez and B. Jiménez)

54. Proper approximate solutions and ε -subdifferentials in vector optimization: Basic properties and limit behaviour. *Nonlinear Analysis Series A: Theory, Methods and Applications* 79, 4 (2013), 52-79 (with C. Gutiérrez, L. Huerga and B. Jiménez)
55. An extension of the Basic Constraint Qualification to nonconvex vector optimization problems. *Journal of Global Optimization* 56, 4 (2013), 1755-1771 (with B. Jiménez and M. Sama)
56. Proper approximate solutions and ε -subdifferentials in vector optimization: Moreau-Rockafellar type theorems. *Journal of Convex Analysis* 21, 3 (2014), 857-886 (with C. Gutiérrez, L. Huerga and B. Jiménez)
57. Existence and boundedness of solutions in infinite dimensional vector optimization problems. *Journal of Optimization Theory and Applications* 162, 2 (2014), 515-547 (with C. Gutiérrez and R. López)
58. Optimality conditions for quasi solutions of vector optimization problems. *Journal of Optimization Theory and Applications* 167, 3 (2015), 796-820 (with C. Gutiérrez and B. Jiménez)
59. Nonlinear scalarizations of set optimization problems with set orderings. In "Set Optimization and Applications. The State of the Art", A. Hamel, F. Heyde, A. Löhne, B. Rudloff, C. Schrage (Eds.), Springer, PROMS series (2015), 43-63 (with C. Gutiérrez and B. Jiménez)
60. Efficiency through variational-like inequalities with Lipschitz functions. *Applied Mathematics and Computation* 259, 2 (2015), 438-449 (with C. Gutiérrez, B. Jiménez and G. Ruiz-Garzón)
61. Vector critical points and efficiency in vector optimization with Lipschitz functions. *Optimization Letters* 10, 1 (2016), 47-62 (with C. Gutiérrez, B.

Jiménez and G. Ruiz-Garzón)

62. Approximation of weak efficient solutions in vector optimization. *Modeling, Computation and Optimization in Information Systems and Management Sciences*, Le Thi Hoai An, Pham Dinh Tao, Nguyen Ngoc Thanh (Eds.), Springer, *Advances in Intelligent Systems and Computing* 359 (2015), 481-489 (with C. Gutiérrez, L. Huerga and B. Jiménez)
63. Duality related to approximate proper solutions of vector optimization problems. *Journal of Global Optimization* 64, 1 (2016), 117-139 (with C. Gutiérrez, L. Huerga and C. Tammer)
64. Chain rules for a proper ε -subdifferential of vector mappings. *Journal of Optimization Theory and Applications* 167, 2 (2015), 502-526. (with C. Gutiérrez, L. Huerga and L. Thibault)
65. Henig approximate proper efficiency and optimization problems with difference of vector mappings. *Journal of Convex Analysis* 23, 3 (2016), 661-690 (with C. Gutiérrez, L. Huerga and B. Jiménez)
66. Convergence of solutions of a set optimization problem in the image space. *Journal of Optimization Theory and Applications* 170, 2 (2016), 358-371 (with C. Gutiérrez, E. Miglierina and E. Molho)
67. Sequential ε -subdifferential calculus for scalar and vector mappings. *Set-Valued and Variational Analysis* 25, 2 (2017), 383-403 (with C. Gutiérrez, L. Huerga and L. Thibault)
68. Approximate Karush-Kuhn-Tucker condition in multiobjective optimization. *Journal of Optimization Theory and Applications* 171, 1 (2016), 70-89 (with G. Giorgi and B. Jiménez)

69. On Hadamard well-posedness of families of Pareto optimization problems. *Journal of Mathematical Analysis and Applications* 444 , 2 (2016), 881-899 (with C. Gutiérrez and R. Lopez)
70. Nonconvex separation functional in linear spaces with applications to vector equilibria. *SIAM Journal on Optimization* 26, 4 (2016), 2677-2695. (with C. Gutiérrez, J.L. Ródenas and T. Tanaka)
71. Nonlinear scalarization in multiobjective optimization with a polyhedral ordering cone. *International Transactions in Operational Research* 25, 3 (2018), 763-779. (with C. Gutiérrez and L. Huerga)
72. Approximate solutions of vector optimization problems via improvement sets in real linear spaces. *Journal of Global Optimization* 70, 4 (2018), 875-901 (with C. Gutiérrez, L. Huerga and B. Jiménez)
73. A note on existence of weak efficient solutions for vector equilibrium problems. *Optimization Letters* 12, 3 (2018), 615-623 (with C. Gutiérrez and J.L. Ródenas)
74. Ekeland variational principles in vector equilibrium problems. *SIAM Journal on Optimization* 27, 4 (2017), 2405-2425 (with C. Gutiérrez, G. Kassay and J.L. Ródenas)
75. A set scalarization function based on the oriented distance and relations with other set scalarizations. *Optimization* 67, 12 (2018), 2091-2116 (with B. Jiménez and A. Vílchez)
76. Limit behaviour of approximate proper solutions in vector optimization. *SIAM Journal on Optimization* 29, 4 (2019), 2677-2696 (with C. Gutiérrez, L. Huerga y M. Sama)

77. Characterization of set relations through extensions of the oriented distance. *Mathematical Methods of Operations Research*, doi 10.1007/s0018-6019-00661-1 (with B. Jiménez and A. Vílchez)
78. Variants of the Ekeland variational principle for approximate proper solutions of vector equilibrium problems. *Journal of Global Optimization* 74, 2 (2019), 361-382 (with L.P. Hai, L. Huerga and P.Q. Khanh)
79. Six set scalarizations based on the oriented distance: properties and application to set optimization. *Optimization* 69, no. 3 (2020), 437-470 (with B. Jiménez and A. Vílchez)
80. Six set scalarizations based on the oriented distance: strict monotonicity and weak minimality. *Journal of Nonlinear and Convex Analysis*, in press (with B. Jiménez and A. Vílchez)
81. Six set scalarizations based on the oriented distance: continuity, convexity and application to convex set optimization. Preprint (with L. Huerga, B. Jiménez and A. Vílchez)
82. Lagrange multipliers in convex set optimization with the set and vector criteria. *Vietnam Journal of Mathematics*, in press (with L. Huerga and B. Jiménez)
83. Necessary conditions for nondominated solutions in vector optimization. Preprint (with T.Q. Bao, L. Huerga and B. Jiménez)
84. Optimality conditions for approximate proper solutions in multiobjective optimization with polyhedral cones. *TOP*, in press (with C. Gutiérrez, L. Huerga and B. Jiménez)
85. Quasi efficient solutions and generalized subdifferential in vector optimization. Preprint (with L. Huerga, B. Jiménez and D.T. Luc)

7. Research Projects and Groups

1. Leader of the Vector Optimization Group. UNED
2. Leader of the project Vector Optimization. BFM-2003-02194, Proyecto de Investigación Científica y Desarrollo Tecnológico, Ministerio de Ciencia y Tecnología of Spain, 2003-2006
3. Leader of the project Vector and Set-Valued Optimization. MTM2006-02629, Plan Nacional de Matemáticas, Ministerio de Educación y Ciencia of Spain, 2006-2009
4. Participant of the project Mathematica-Consolider. Main researcher M.A. López Cerdá. CSD2006-00032, Ministerio de Educación y Ciencia, 2006-2010
5. Leader of the project Optimization of Vector Functions and Set-Valued Maps. MTM2009-09493, Plan Nacional de Matemáticas, Ministerio de Ciencia e Innovación of Spain, 2010-2013
6. Leader of the project Optimization of Vector Functions and Set-Valued Maps. MTM2012-30942, Plan Nacional de Matemáticas, Ministerio de Economía y Competitividad, 2013-2016
7. Leader of the project Optimization and Equilibrium Problems with Vector and Set-Valued Mappings. MTM2015-68103-P, Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia, Ministerio de Economía y Competitividad, 2016-2019
8. Leader of the project Vector and Set Optimization Problems. PGC2018-096899-B-I00, Programa Estatal de Generación del Conocimiento y Fortalecimiento Científico y Tecnológico del Sistema de I+D+i, Ministerio de Ciencia, Innovación y Universidades, 2019-2020

8. Conferences and Workshops (2001 →)

1. Generalized convexity and applications to the vector optimization. International Congress Optimization 2001. Aveiro, Portugal, July 2001 (with M. Adán)
2. Lagrange multipliers in multiobjective optimization under mixed assumptions of Fréchet and directional differentiability. 5th International Conference on Operations Research. La Habana, Cuba. March 2002 (with B. Jiménez)
3. Some relations of ε -efficiency with other notions of efficiency in vector optimization. IV International-Brazilian Workshop on Continuous Optimization. Rio de Janeiro, Brazil, July 2002 (with C. Gutiérrez and B. Jiménez)
4. Minimum principle-type optimality conditions for Pareto problems. XXVI Conv. Associazione per la Matem. Appl. alle Science Economiche e Sociale. Verona, Italy. September 2002 (with G. Giorgi and B. Jiménez)
5. On a new concept of proper approximate Pareto efficiency. 18th International Symposium on Mathematical Programming. Copenhagen, Denmark, August 2003 (with C. Gutiérrez and B. Jiménez)
6. Teoremas de dualidad en programación vectorial no convexa con un enfoque algebraico. Proceedings XVIII Congreso Ecuac. Difer. Aplic. / VIII Congreso Matem. Aplicada. Tarragona, Spain. September 2003 (with M. Adán)
7. Conditions and parametric representations of approximate minimal elements of a set through scalarization. Proceedings 40th Workshop on Large Scale Nonlinear Optimization. Erice, Italy. June-July 2004. Large Scale

- Nonlinear Optimization. G di Pillo, M. Roma eds., Nonconvex optimization and its applications 83, Springer 2006, 173-184 (with C. Gutiérrez and B. Jiménez)
8. Benson proper efficiency in set-valued optimization on real linear spaces. 12th French-German-Spanish Conference on Optimization. Avignon, France. September 2004 (with E. Hernández and B. Jiménez)
 9. Higher-order optimality conditions for strict local minima. CLAIO 2004. La Habana, Cuba. October 2004 (with B. Jiménez)
 10. Sufficient optimality conditions and duality in nonsmooth multiobjective optimization problems under generalized convexity. 8th International Symposium on Generalized Convexity/Monotonicity. Varese, Italy. July 2005 (with G. Giorgi and B. Jiménez)
 11. Optimality conditions for Tanaka's approximate solutions in vector optimization. 8th International Symposium on Generalized Convexity/Monotonicity. Varese, Italy. July 2005 (with C. Gutiérrez and B. Jiménez)
 12. A new concept of approximate efficiency in multiobjective mathematical programming. Proceedings ORP3 Meeting. Valencia, Spain. September 2005. C. Maroto et al. Eds. ESMAP, S.L. 2005, 65-74 (with C. Gutiérrez and B. Jiménez)
 13. Conditions for ε -Pareto solutions in multiobjective optimization. Proceedings International Workshop on Global Optimization, GO05. Almería, Spain. September 2005. I. García et al. Eds. 2005, 121-125 (with C. Gutiérrez and B. Jiménez)

14. Condiciones de optimalidad de orden superior para mínimos estrictos. Proceedings XXIX Congreso Nacional de Estadística e Investigación Operativa. Tenerife, Spain. May 2006. In Contribuciones a la Estadística y la Investigación Operativa. J. Sicilia et al. Eds. 2006, 251-263 (with C. Gutiérrez and B. Jiménez)
15. Parametric representations for ε -efficient sets in vector optimization problems. XXI European Conference on Operational Research EUROXXI. Reykjavik, Iceland. July 2006 (with C. Gutiérrez and B. Jiménez)
16. A second order directional derivative and optimality conditions in scalar and Pareto optimization. ICM 2006. Madrid, Spain. August 2006 (with C. Gutiérrez and B. Jiménez)
17. Optimality conditions in vector optimization problems. Invited talk. Iberian Conference in Optimization. Coimbra. Portugal, November 2006
18. Conditions for approximate Pareto solutions of nonconvex multiobjective optimization problems via scalarization. Iberian Conference in Optimization. Coimbra, Portugal. November 2006 (with C. César Gutiérrez and B. Jiménez)
19. Strong Kuhn-Tucker conditions and constraint qualifications in locally Lipschitz multiobjective optimization problems. Invited talk. XXII European Conference on Operational Research EUROXXII. Prague, Czech Republic. July 2007 (with G. Giorgi and B. Jiménez)
20. Some applications of invexity and generalized invexity to Pareto optimization problems. Invited talk. XXII European Conference on Operational Research EUROXXII. Prague, Czech Republic. July 2007 (with G. Giorgi and B. Jiménez)

21. Relations between epsilon-efficient solutions of vector optimization problems and approximate solutions of scalarizations. Invited talk. XXII European Conference on Operational Research EUROXXII. Prague, Czech Republic. July 2007 (with C. Gutiérrez and B. Jiménez)
22. The concept of (C, ε) -efficient solution in vector optimization problems. EUROPT-OMS Meeting 2007, 2nd Conference on Optimization Methods and Software and 6th EUROPT Workshop on Advances in Continuous Optimization. Prague, Czech Republic. July 2007 (with C. Gutiérrez and B. Jiménez)
23. Approximate minimality in vector optimization via co-radiant sets. Invited talk. 11-th Workshop on Well-Posedness of Optimization Problems and Related Topics. Alicante, Spain. September 2007 (with C. Gutiérrez and B. Jiménez)
24. Condiciones de optimalidad en programas multiobjetivo con funciones estables. XXX Congreso Nacional de Estadística e Investigación Operativa. Valladolid, Spain. September 2007 (with C. Gutiérrez and B. Jiménez)
25. An overview of second order tangent sets and their application in vector optimization. Invited talk. Workshop on Nonsmooth Analysis, Optimization and Applications. Erice, Italy. May 2008 (with G. Giorgi and B. Jiménez)
26. A set-valued approach to the Ekeland variational principle in vector optimization. Invited talk. 5th Workshop on Vector Optimization and Related Topics. Madrid, Spain. June 2008 (with C. Gutiérrez and B. Jiménez)
27. Some remarks on strict minimality in vector and set-valued optimization. XIV Congreso Latino Ibero Americano de Investigación de Operaciones (CLAIO 2008). Cartagena de Indias, Colombia. September 2008 (with B. Jiménez and M. Sama)

28. Strong convexity of higher order and strict minimizers in multiobjective optimization. XIV Congreso Latino Ibero Americano de Investigación de Operaciones (CLAIO 2008). Cartagena de Indias, Colombia. September 2008 (with C. Gutiérrez and B. Jiménez)
29. New versions of the variational principle in vector optimization. Invited talk. 2nd ALEL Meeting. Alicante, Spain. June 2009 (with C. Gutiérrez and B. Jiménez)
30. The Ekeland variational principle in vector optimization using set-valued perturbations. 7th EUROPT Workshop Advances in Continuous Optimization. Remagen, Germany. July 2009 (with C. Gutiérrez and B. Jiménez)
31. Some remarks on strong convexity and optimality conditions in multiobjective programming problems. Invited talk. XXIII European Conference on Operational Research EUROXXIII. Bonn, Germany. July 2009 (with C. Gutiérrez and B. Jiménez)
32. On the characterization of approximate efficiency in vector optimization via approximate solutions of some scalarized problems. Invited talk. XXIII European Conference on Operational Research EUROXXIII. Bonn, Germany. July 2009 (with C. Gutiérrez and B. Jiménez)
33. Graphical differentiation in vector analysis and its application in optimization. Invited talk. XXIII European Conference on Operational Research EUROXXIII. Bonn, Germany. July 2009 (with B. Jiménez and M. Sama)
34. On continuity properties in vector optimization. XXIII European Conference on Operational Research EUROXXIII. Bonn, Germany. July 2009 (with C. Gutiérrez and R. López)
35. Limit behavior of approximate solutions of vector optimization problems.

- International Functional Analysis Meeting in Valencia FAV2010. Valencia, Spain. June 2010 (with C. Gutiérrez and B. Jiménez)
36. Some new results on approximate solutions of vector optimization problems. Invited talk. 4th Workshop on Optimization and Variational Analysis. Elche, Spain. June 2010 (with C. Gutiérrez and B. Jiménez)
 37. A note on second-order optimality conditions in nonsmooth multiobjective optimization. 4th Workshop on Optimization and Variational Analysis. Elche, Spain, June 2010 (with C. Gutiérrez and B. Jiménez)
 38. Existence of solutions in vector optimization problems via asymptotic analysis. Invited talk. 8th EUROPT Workshop Advances in Continuous Optimization. Aveiro, Portugal. July 2010 (with C. Gutiérrez, B. Jiménez and R. López)
 39. Optimality conditions in scalar and vector optimization using a new second order directional derivative. Invited talk. XXIV European Conference on Operational Research EUROXXIV. Lisbon, Portugal. July 2010 (with C. Gutiérrez and B. Jiménez)
 40. Graphical differentiation of the gradient. Invited talk. XXIV European Conference on Operational Research EUROXXIV. Lisbon, Portugal, July 2010 (with B. Jiménez and M. Sama)
 41. Convexidad fuerte y minimales estrictos globales en programación multiobjetivo. XXXII Congreso Nacional de Estadística e Investigación Operativa. La Coruña, Spain. September 2010 (with C. Gutiérrez and B. Jiménez)
 42. On the notion of approximate strict solution in set-valued optimization via the set solution criterion. Invited talk. SIAM Conference on Optimization (OP11). Minisymposium: Vector and Set Optimization. Darmstadt,

- Germany, May 2011 (with C. Gutiérrez, B. Jiménez and Lionel Thibault).
43. A new concept of approximate minimal point with applications to vector set-valued optimization problems. Invited talk. Workshop on Optimization and Related Topics. Milano, Italy, May 2011 (with C. Gutiérrez and B. Jiménez).
 44. An approximate Ekeland variational principle in set-valued optimization. Invited talk. III ALEL Meeting on Optimization. Castro Urdiales, Spain. June 2011 (with C. Gutiérrez, B. Jiménez and L. Thibault).
 45. Saddle point results for approximate Benson proper solutions of multiobjective optimization problems. Poster. III ALEL Meeting on Optimization. Castro Urdiales, Spain. June 2011 (with C. Gutiérrez and L. Huerga).
 46. A vector version of Brézis–Browder principle. Invited talk. International Conference Optimization, Theory, Algorithms and Applications in Economics OPT2011. Barcelona, Spain. October 2011. (with C. Gutiérrez and B. Jiménez).
 47. A characterization of approximate proper efficiency in vector optimization problems through scalarization. International Conference Optimization, Theory, Algorithms and Applications in Economics OPT2011. Barcelona, Spain. October 2011 (with C. Gutiérrez and L. Huerga).
 48. A constraint qualification for vector optimization problems based on a half-space decoupling of the constraint cone. International Conference Optimization, Theory, Algorithms and Applications in Economics OPT2011. Barcelona, Spain. October 2011 (with B. Jiménez and M Sama).
 49. KKT conditions for a nonconvex vector optimization problem. 2012 Joint Mathematics Meetings of the Mathematical Association of America and

- the American Mathematical Society. Invited talk. Boston, USA. January 2012 (with B. Jiménez and M Sama).
50. Pointwise well-posedness and scalarization in set optimization. First French-Italian Workshop on Energy Markets and Models, FIWEM'1. Brescia, Italy. March 2012 (with C. Gutiérrez, E. Miglierina and E. Molho).
 51. Optimalidad Lagrangiana para soluciones aproximadas propias en optimización vectorial. XXXIII Congreso de Estadística e Investigación Operativa SEIO2012. Madrid, Spain. April 2012 (with C. Gutiérrez and L. Huerga).
 52. Conceptos de eficiencia aproximada equivalentes en optimización multiobjetivo. XXXIII Congreso de Estadística e Investigación Operativa SEIO2012. Madrid, Spain. April 2012 (with C. Gutiérrez and B. Jiménez).
 53. Saddle point results for approximate proper efficiency in vector optimization problems. XXV European Conference on Operational Research EUROXXV. Vilnius, Lithuania. July 2012 (with L. Huerga and C. Gutiérrez).
 54. A notion of well-posedness in set-valued optimization. XXV European Conference on Operational Research EUROXXV. Vilnius, Lithuania. July 2012 (with E. Molho, E. Miglierina and E. Molho).
 55. Approximation of efficient sets via ε -efficient sets. 21st International Symposium on Mathematical Programming (ISMP). Berlin, Germany. August 2012 (with C. Gutiérrez and B. Jiménez).
 56. Characterization and properties of approximate proper solutions in vector optimization problems. 22nd International Conference on Multiple Criteria Decision Making. MCDM2013. Málaga, Spain. June 2013 (with C. Gutiérrez, L. Huerga and B. Jiménez).

57. Approximate proper solutions of vector optimization problems. Properties and limit behaviour. XXVI European Conference on Operational Research EURO-INFORMS MMXIII. Rome, Italy. July 2013 (with L. Huerga, C. Gutiérrez and B. Jiménez).
58. A new concept of solution in vector optimization defined via improvement sets. XXVI European Conference on Operational Research EURO-INFORMS MMXIII. Rome, Italy. July 2013 (with C. Gutiérrez and B. Jiménez).
59. A scalarization scheme in set optimization with applications to Tykhonov well-posedness. XXVI European Conference on Operational Research EURO-INFORMS MMXIII. Rome, Italy. July 2013 (with C. Gutiérrez, E. Miglierina and E. Molho).
60. Soluciones basadas en conjuntos de mejora en optimización vectorial. XXIV Congreso de Estadística e Investigación Operativa SEIO2013. Castellón, Spain. September 2013 (with C. Gutiérrez and B. Jiménez).
61. Relación entre la eficiencia y la eficiencia propia aproximada Benson en optimización vectorial. XXXIV Congreso de Estadística e Investigación Operativa SEIO2013. Castellón, Spain. September 2013 (with L. Huerga, C. Gutiérrez and B. Jiménez).
62. A new notion of proper ε -subdifferential for vector mappings. Properties and existence conditions. 12th EUROPT Workshop Advances in Continuous Optimization. Perpignan, France. July 2014 (with L. Huerga, C. Gutiérrez and B. Jiménez).
63. On a new Benson proper ε -subdifferential for vector-valued mappings. XI International Symposium on Generalized Convexity and Monotonicity. Rio

- de Janeiro, Brazil. August 2014 (with L. Huerga, C. Gutiérrez and B. Jiménez).
64. Optimality conditions for approximate solutions of unconstrained vector optimization problems. XI International Symposium on Generalized Convexity and Monotonicity. Rio de Janeiro, Brazil. August 2014 (with C. Gutiérrez, B. Jiménez and M. Sama).
 65. Duality results for approximate proper solutions in vector optimization. South Pacific Continuous Optimization Meeting (SPCOM 2015). Adelaide, Australia. February 2015 (with C. Gutiérrez, L. Huerga and C. Tammer).
 66. Approximation of weak efficient solutions in vector optimization. Modelling, Computation and Optimization in Information Systems and Management Sciences (MCO 2015). University of Lorraine, Metz, France. May 2015 (with L. Huerga, C. Gutiérrez and B. Jiménez).
 67. On a proper ε -subdifferential for vector mappings. Chain rules. XXVII European Conference on Operational Research (EURO2015). University of Strathclyde, Glasgow, United Kingdom. July 2015 (with C. Gutiérrez, L. Huerga and L. Thibault).
 68. Proper efficiency in multiobjective optimization with a polyhedral ordering cone. 7th International Seminar on Optimization and Variational Analysis (OVA7), Alicante, Spain. June 2016 (with C. Gutiérrez and L. Huerga).
 69. Scalarization in ordered sets. International Conference in Optimization Theory and its Applications, ALEL2016. Cartagena, Spain. June 2016 (with C. Gutiérrez and L. Huerga).
 70. Caracterización por escalarización no lineal de soluciones propias Henig en programación multiobjetivo. X Reunión del Grupo Español de Decisión

- Multicriterio. Universidad CEU San Pablo, Madrid, Spain. June 2016 (with C. Gutiérrez and L. Huerga).
71. Limit behaviour and nonlinear scalarization of approximate efficient solutions in vector optimization. XXVIII European Conference on Operational Research (EURO2016). University of Poznan, Poznan, Poland. July 2016 (with C. Gutiérrez, L. Huerga and B. Jiménez).
 72. Henig proper efficiency for vector equilibrium problems on linear spaces. XXVIII European Conference on Operational Research (EURO2016). University of Poznan, Poznan, Poland. July 2016 (with C. Gutiérrez and J.L. Ródenas).
 73. Una noción de eficiencia propia para problemas de equilibrio vectorial. XXXVI Congreso de Estadística e Investigación Operativa SEIO2016. Toledo, Spain. September 2016 (with C. Gutiérrez and J.L. Ródenas).
 74. Stability in set optimization: an image space approach. Congreso bienal de la Real Sociedad Matemática Española RSME2017. Zaragoza, Spain. January 2017 (with C. Gutiérrez, E. Miglierina and E. Molho).
 75. Duality results and ε -subdifferential related to approximate proper solutions of a vector optimization problem. Congreso bienal de la Real Sociedad Matemática Española RSME2017. Zaragoza, Spain. January 2017 (with C. Gutiérrez, L. Huerga and B. Jiménez).
 76. Nonlinear scalarization via algebraic mathematical tools. Congreso bienal de la Real Sociedad Matemática Española RSME2017. Zaragoza, Spain. January 2017 (with C. Gutiérrez and J.L. Ródenas).
 77. Existence results for vector equilibrium problems in an algebraic setting. XXV Congreso de Ecuaciones Diferenciales y Aplicaciones. XV Congreso

- de Matemática Aplicada CEDYA+CMA2017. Cartagena, Spain. June 2017 (with C. Gutiérrez and J.L. Ródenas).
78. Characterization of proper efficient solutions in non-convex multiobjective optimization with a polyhedral ordering cone. 8th International Seminar on Optimization and Variational Analysis (OVA8). Alicante, Spain. June 2017 (with C. Gutiérrez and L. Huerga).
 79. Escalarización de soluciones propias en optimización multiobjetivo con conos de orden poliédricos. XXVI Congreso de Matemáticas Capricornio COMCA 2017. Arica, Chile. August 2017 (with C. Gutiérrez and L. Huerga).
 80. Nonlinear scalarization in real linear spaces and vector equilibrium problems. 12th International Symposium on Generalized Convexity and Monotonicity. Hajdúszoboszló, Hungary. August 27 to September 2, 2017 (with C. Gutiérrez and J.L. Ródenas).
 81. Characterization of proper efficiency in multiobjective optimization through nonlinear scalarization. 12th International Symposium on Generalized Convexity and Monotonicity. Hajdúszoboszló, Hungary. August 27 to September 2, 2017 (with C. Gutiérrez and L. Huerga).
 82. Approximate solutions of vector optimization problems via improvement sets in real linear spaces. XXXVII Congreso Nacional de Estadística e Investigación Operativa. Oviedo, Spain. May 29 to June 1, 2018 (with L. Huerga, C. Gutiérrez and B. Jiménez).
 83. Approximate Henig proper solutions in vector optimization with difference of mappings. XXXVII Congreso Nacional de Estadística e Investigación Operativa. Oviedo, Spain. May 29 to June 1, 2018 (with L. Huerga, C. Gutiérrez and B. Jiménez).

84. Ekeland variational principles for bifunctions via algebraic concepts in the image space. XXXVII Congreso Nacional de Estadística e Investigación Operativa. Oviedo, Spain. May 29 to June 1, 2018 (with C. Gutiérrez and J.L. Ródenas).
85. Limit behaviour of Henig approximate proper solutions in vector optimization. XXIX European Conference on Operational Research (EURO2018). University of Valencia, Spain. July 2018 (with L. Huerga, C. Gutiérrez and M. Sama).
86. Existence of approximate strict solutions of optimization problems. XXIX European Conference on Operational Research (EURO2018). University of Valencia, Spain. July 2018 (with C. Gutiérrez and J.L. Ródenas).
87. A Weierstrass theorem for weakly efficient solutions of vector equilibrium problems. XXIX European Conference on Operational Research (EURO2018). University of Valencia, Spain. July 2018 (with C. Gutiérrez and J.L. Ródenas).
88. Algebraic nonlinear scalarization in ordered linear spaces. 16th EUROPT Workshop on Advances in Continuous Optimization (EUROPT2018). University of Almería, Spain. July 2018 (with C. Gutiérrez and J.L. Ródenas).
89. Characterization of approximate proper efficiency in vector optimization with difference of mappings. XXX European Conference on Operational Research (EURO2019). University College Dublin, Ireland. June 2019 (with L. Huerga, C. Gutiérrez and B. Jiménez).
90. Optimality conditions for proper solutions in multiobjective optimization with a polyhedral cone. XXXVIII Congreso Nacional de Estadística e Investigación Operativa. Alcoi, Spain. September 3-6, 2019 (with L. Huerga, C. Gutiérrez and B. Jiménez).

91. A set scalarization function based on the oriented distance: first properties and applications to set optimization. XXXVIII Congreso Nacional de Estadística e Investigación Operativa. Alcoi, Spain. September 3-6, 2019 (with B. Jiménez and A. Vílchez).

9. Advisor of Doctoral Thesis

1. Author: Bienvenido Jiménez
Title: Condiciones de Optimalidad en Programación Multiobjetivo
Date: December 2000
2. Author: Miguel Adán
Title: Condiciones de Optimalidad en Programas Vectoriales con Convexidad Generalizada.
Date: June 2001
3. Author: César Gutiérrez
Title: Condiciones de ε -eficiencia en Optimización Vectorial.
Date: November 2004
4. Author: Lidia Huerga
Title: Soluciones Propias Aproximadas de Problemas de Optimización Vectorial.
Date: October 2014
5. Author: Juan Luis Ródenas
Title: Caracterización de Soluciones de Problemas de Equilibrio Vectoriales.
Date: June 2018
6. Author: Antonio Vilchez
Title: Escalarizaciones Conjuntistas Basadas en la Distancia Orientada con

Aplicaciones en Optimización de Multifunciones.

Date: October 2019

10. Referee for:

Estadística Española; Revista Iberoamericana de Ingeniería Mecánica; Journal of Mathematical Analysis and Applications; Journal of Global Optimization; SIAM Journal on Control and Optimization; Soochow Journal of Mathematics; Lecture Notes in Economics and Mathematical Systems; Journal of Convex Analysis; TOP; Nonlinear Analysis. Theory, Methods and Applications; Mathematical Methods of Operations Research; European Journal of Operational Research; Applied Mathematics Letters; Journal of Industrial and Management Optimization; Computers and Mathematics with Applications; Journal of Optimization Theory and Applications; Optimization; Numerical Functional Analysis and Optimization; Positivity; Optimization Letters; Acta Mathematica Sinica; SIAM Journal on Optimization.

11. Other Professional Achievements

1. Coordinator of PhD Studies. Department of Applied Mathematics, UNED, 1993-2006
2. Evaluation of research activities by Comisión Nacional Evaluadora de la Actividad Investigadora: Positive assessment for periods 2000-2005, 2006-2011 and 2012-2017
3. Reviewer of research projects I+D+i and postgraduate grants, appointed by the “Agencia Nacional de Evaluación y Prospectiva” ANEP (Ministerio de Ciencia e Innovación of Spain). 2006 →

4. Reviewer of research projects, appointed by the “Fundación CSIC” (Consejo Superior de Investigaciones Científicas, Spain). 2010 →
5. Associate Editor:
 - Australian Journal of Mathematical Analysis and Applications, 2004→
 - TOP, 2013→
6. Committees:
 - International Program Committee Euro Mini Conference Continuous Optimization and Knowledge-Based Technologies (Eur-OPT 2008), Neringa, Lithuania, May 20-23, 2008
 - International Program Committee XIV Congreso Latino Ibero Americano de Investigación de Operaciones (CLAIO 2008), Cartagena de Indias, Colombia, September 9-12, 2008
 - Scientific Committee XXXI Congreso Nacional de Estadística e Investigación Operativa/V Jornadas de Estadística Pública, Murcia, February 10-13, 2009
 - International Organizing Committee 8th EUROPT Workshop on Continuous Optimization, Aveiro, Portugal, July 9-10, 2010
 - Scientific Committee XXXII Congreso Nacional de Estadística e Investigación Operativa/VI Jornadas de Estadística Pública, La Coruña, September 2010
 - Scientific Committee Third International Conference on Set-Valued Variational Analysis and Set Optimization with Applications in Economics, Finance, Statistics and Game Theory, Vienna University of Economics and Business, Vienna, September 19-23, 2016

- Invited cluster on Multi-Objective and Vector Optimization. XIV Congreso Latino Ibero Americano de Investigación de Operaciones (CLAIO 2008). Cartagena de Indias, Colombia, September 9-12, 2008
- Invited stream on Vector and Set-Valued Optimization. XXIII European Conference on Operations Research. Bonn, July 5-8, 2009
- Invited stream on Vector and Set-Valued Optimization. XXIV European Conference on Operations Research. Lisbon, July 11-14, 2010
- Invited stream on Vector and Set-Valued Optimization. XXV European Conference on Operations Research. Vilnius, July 8-11, 2012
- Invited session on Vector Optimization in the cluster Multi-Objective Optimization organized by Joerg Fliege y Johannes Jahn. 21st International Symposium on Mathematical Programming (ISMP2012). Berlín, August 19-24, 2012
- 6th Workshop on Vector Optimization and Related Topics. UNED, Madrid, November 7-8, 2012
- Invited session on Approximate Solutions and Optimality Conditions in Vector Optimization. 22nd International Conference on Multiple Criteria Decision Making. MCDM2013. Málaga, June 17-21, 2013
- Invited stream on Vector and Set-Valued Optimization. XXVI European Conference on Operations Research. Rome, July 1-4, 2013
- 7th Workshop on Vector Optimization and Related Topics. UNED, Madrid, October 24, 2014
- Invited stream on Vector and Set-Valued Optimization. XXVII European Conference on Operations Research. Glasgow, July 12-15, 2015
- Invited stream on Vector and Set-Valued Optimization. XXVIII European Conference on Operations Research. Poznan, July 3-6, 2016

- Invited session titled Optimización Continua 1. XXXVII Congreso Nacional de Estadística e Investigación Operativa. Oviedo, May 29 to June 1, 2018
- Invited stream on Vector and Set-Valued Optimization. XXIX European Conference on Operations Research. Valencia, July 8-11, 2018
- Invited stream on Vector and Set-Valued Optimization. XXX European Conference on Operations Research. Dublin, June 23-26, 2019

10. Member of:

- Sociedad Española de Estadística e Investigación Operativa (SEIO)
- Sociedad Española de Matemática Aplicada (SEMA)
- Working Group on Generalized Convexity (WGGC)
- EUROPT - The Continuous Optimization Working Group of EURO
- The Pacific Optimization Research Activity Group (POP)
- Grupo SEIO de Decisión Multicriterio
- Grupo Español de Decisión Multicriterio (GEDM)
- International Society on Multiple Criteria Decision Making (MCDM)
- Grupo SEIO de Optimización Continua

11. Member of the Operational Research Academic Council. Sociedad Española de Estadística e Investigación Operativa. From September 2007 to September 2010.