

Modelización Matemática en Ciencia y Tecnología (MOMACyT)

Características generales

Características del Equipo de Investigación

Características de la Investigación



IDENTIFICACIÓN DEL EQUIPO INVESTIGADOR

NOMBRE DEL EQUIPO O GRUPO DE INVESTIGACIÓN	Modelización Matemática en Ciencia y Tecnología (MOMACyT)
UNIDAD/DEPARTAMENTO DE PERTENENCIA	Departamento de Matemática Aplicada
CENTRO/INSTITUTO/UNIVERSIDAD/ORGANISMO DE PERTENENCIA	Instituto Universitario de Física Fundamental y Matemáticas, Universidad de Salamanca



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**INVESTIGADOR PRINCIPAL**

**NOMBRE**

Ángel María Martín del Rey

**TITULACIÓN**

Doctor en Ciencias Matemáticas

**TRAYECTORIA PROFESIONAL**

A. Martín del Rey received the B.S. and M.S. degrees in Mathematics from University of Salamanca in 1996, and the Ph.D. degree in Mathematics from UNED/CSIC, in 2000. Since 2008, he has been an assistant professor with the Department of Applied Mathematics, Universidad de Salamanca (Spain). He is the author of 61 articles published in journals indexed in WoS-JCR, 39 conference proceedings indexed in CPCI-S (WoS), and 25 papers in other international journals.

He is member of the editorial board of the journal "Security and Communication Networks" (indexed in WoS-JCR) and editor of special issues appeared in "Mathematics" (WoS-JCR), "Sensors" (WoS-JCR) and "Security and Communication Networks" (WoS-JCR). He has also been member of the scientific committee of national and international conferences (RECSI, CIBSI, CEDI, CISIS).

He has been evaluator of research proposals for national (ANEP) and international agencies (FONDECYT), reviewer of several journals indexed in JCR-SCI. He has been chair of the department of Applied Mathematics, University of Salamanca (2010-2018) and currently is the chair of the Institute of Fundamental Physics and Mathematics (University of Salamanca). He is scientific member of Spanish Royal Mathematical Society (RSME), Spanish Society of Applied Mathematics (SEMA), Spanish Artificial Intelligence Association (AEPIA), European Mathematical Society (EMS), and Institute of Electronical and Electric Engineers (IEEE).

His research interests include malware propagation, mathematical models for security and cyber-security, cryptography, complex network analysis and cellular automata.

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**MIEMBROS DEL EQUIPO**

Queiruga Dios, M<sup>a</sup> Araceli  
García Cobo, Iván  
Quintero Bonilla, Santiago

Martín Vaquero, Jesús  
Maurín Saldaña, Esteban Enrique

Hernández Guillén, José D  
Batista Guerra, Farrah



LÍNEAS Y ÁREAS DE INVESTIGACIÓN

ÁREAS DE INVESTIGACIÓN	PRINCIPALES LÍNEAS DE INVESTIGACIÓN
ATAQUES Y DEFENSA ANTE AMENAZAS	Detección y monitorizado de ataques Simulación de entornos infectados por malware
INFRAESTRUCTURAS CRÍTICAS	Modelado de sistemas y de ataques a sistemas
PRIVACIDAD	Protocolos criptográficos de preservación de la privacidad



PUBLICACIONES RELACIONADAS DESTACADAS

**PUBLICACIONES AÑO 2020**

A. Martín del Rey, G. Hernández, A. Bustos Tabernero, A. Queiruga Dios, *Advanced malware propagation on random complex networks*, *Neurocomputing* 423 (2021) 689-696.

J.J. Bullón Pérez, A. Queiruga-Dios, V. Gayoso Martínez, A. Martín del Rey, *Traceability of ready-to-wear clothing through blockchain technology*, *Sustainability* 12 (2020) 7491 (21 pages)

J.D. Hernández Guillén, A. Martín del Rey, R. Casado Vara, *On the optimal control of a malware propagation model*, *Mathematics* 8 (2020) 1518 (16 pages).

S. Quintero Bonilla, A. Martín del Rey, *A new proposal on the advanced persistent threat: A survey*, *Appl. Sci.-BASEL* 10 (2020) 3874 (22 pages).

F. Kristel Batista, A. Martín del Rey, A. Queiruga Dios, *A new individual-based model to simulate malware propagation in wireless sensor networks*, *Mathematics* 8(3) (2020) 410 (23 pages)

J.D. Hernández Guillén, A. Martín del Rey, *A mathematical model for malware spread on WSNs with population dynamics*, *Physica A* 545 (2020) Article ID 123609 (11 pages)

A. Martín del Rey, A. Queiruga Dios, G. Hernández, A. Bustos Tabernero, *Modeling the spread of malware on complex networks*, *Adv. Intell. Syst. Comput.* 1004 (2020) 109-116.

S. Quintero Bonilla, A. Martín del Rey, *Proposed models for advanced persistent threat detection: a review*, *Adv. Intel. Syst. Comput.* 1004 (2020) 141-148.

F. Batista Guerra, A. Martín del Rey, A. Queiruga Dios, *A review of SEIR-D agent based model*, *Adv. Intell. Syst. Comput.* 1004 (2020) 133-140.

**PUBLICACIONES AÑO 2019**

J.D. Hernández Guillén, A. Martín del Rey, R. Casado Vara, *Security countermeasures of a SCIRAS model for advanced malware propagation*, *IEEE Access* 7 (2019) 135472-135478.

A. Martín del Rey, J.D. Hernández Guillén, G. Rodríguez Sánchez, *Study of the malware SCIRS model with different incidence rates*, *Log. J. IGPL* 27(2) (2019) 202-213.

A. Martín del Rey, L.-X. Yang, V.A. Karyotis, *Mathematical Models for Malware Propagation*, *Secur. Comm. Netw.* 2019, Article ID 6046353 (2 pages).

A. Martín del Rey, R. Casado Vara, D. Hernández Serrano, *Reversibility of symmetric linear cellular automata with radius  $r=3$* , *Mathematics* 7 (9) (2019) 816 (15 pages).

D. Hernández Serrano, A. Martín del Rey, *A closed formula for the inverse of a reversible cellular automaton with  $(2R+1)$ -cyclic rule*, *Appl. Math. Comput.* 357 (2019) 23-34.

**PUBLICACIONES AÑO 2018**

J.D. Hernández Guillén, A. Martín del Rey, *Modeling malware propagation using a carrier compartment*, *Commun. Nonlinear Sci. Numer. Simulat.* 56 (2018) 217-226.

J.D. Hernández Guillén, A. Martín del Rey, L. Hernández Encinas, *New approaches of epidemics models to simulate malware propagation*, *Adv. Intell. Syst. Comput.* 649 (2018) 631-640.

F.K. Batista Guerra, A. Martín del Rey, S. Quintero Bonilla, A. Queiruga Dios, *A SEIR model for computer virus spreading based on cellular automata*, *Adv. Intell. Syst. Comput.* 649 (2018) 641-650.

S. Quintero-Bonilla, A. Martín del Rey, A. Queiruga Dios, *New perspectives in the study of Advanced Persistent Threats*, *Proceedings of the International Conference on Practical Applications of Agents and Multi-Agent Systems*, *Adv. Intell. Syst. Comput.* 619 (2018) 242-244.

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A. Martín del Rey, A. Peinado, *Mathematical models for malware propagation in Wireless Sensor Networks: An analysis*, *Computer and Network Security Essentials Book*, K. Dairi (ed.), Springer International Publishing AG 2018 pp. 299-313.

J. Martín Vaquero, A. Queiruga Dios, V. Gayoso Martínez, A. Hernández Encinas, A. Martín del Rey, *Numerical schemes for general Klein-Gordon Equations with Dirichlet and nonlocal boundary conditions*, *Nonlinear Anal.-Model Control* 23 (2018) 50-62.

L. Hernández Encinas, A. Martín del Rey, *Boolean differential operators*, *Turk. J. Math.* 42 (2018) 57-68.

J. Martín Vaquero, A. Queiruga Dios, A. Hernández Encinas, A. Martín del Rey, G. Rodríguez Sánchez, J.D. Hernández Guillén, *Variable step length algorithms with high-order extrapolated non-standard finite difference schemes for a SEIR malware model*, *J. Comput. Appl. Math.* 330 (2018) 848-854.

**PUBLICACIONES AÑO 2017**

F.K. Batista, A. Martín del Rey, A. Queiruga Dios, *Malware propagation in Wireless Sensor Networks: global models vs Individual-based models*, *Advances in Distributed Computing and Artificial Intelligence Journal* 6 (3) (2017) 5-15.

A. Martín del Rey, *Chaotic encryption of 3D objects*, *Proceedings of the International Work-Conference on the Interplay Between Natural and Artificial Computation*, *Lect. Notes Comput. Sci.* 10338 (2017) 463-472.

J.D. Hernández Guillén, A. Martín del Rey, L. Hernández Encinas, *Study of the stability of a SEIRS model for computer worm propagation*, *Physica A* 479 (2017) 411-421.

J. Martín Vaquero, A. Martín del Rey, A. Hernández Encinas, J.D. Hernández Guillén, A. Queiruga Dios, G. Rodríguez Sánchez, *Higher-order nonstandard finite difference for a MSEIR model for malware propagation*, *J. Comput. Appl. Math.* 317 (2017) 146-156.

**PUBLICACIONES AÑO 2016**

A. Martín del Rey, J.D. Hernández Guillén, G. Rodríguez Sánchez, *A SCIRS model for malware propagation in wireless networks*, *Adv. Intell. Syst. Comput.* 527 (2016) 538-547.

A. Martín del Rey, J.D. Hernández Guillén, G. Rodríguez Sánchez, *Modeling malware propagation in wireless sensor networks with individual-based models*, *Lect. Notes Artif. Intell.* 9868 (2016) 194-203.

A. Martín del Rey, J.L. Hernández Pastora, G. Rodríguez Sánchez, *3D medical data security protection*, *Expert Syst. Appl.* 54 (2016) 379-386.

A. Martín del Rey, G. Rodríguez Sánchez, *Application to Cybersecurity of the Stability Theory of the Systems of Ordinary Differential Equations*, *Geometry, Algebra and Applications: From Mechanics to Cryptography*, Springer Proceedings in Mathematics and Statistics, vol. 161, pp. 157-169.

J. Martín Vaquero, A. Hernández Encinas, V. Gayoso Martínez, A. Martín del Rey, A. Queiruga Dios, *A study on the efficiency and stability of high-order numerical methods for Form-II and Form-III of the non-linear Klein-Gordon equations*, *Int. J. Mod. Phys. C* 27 (9) (2016), 1650097 (18 pages).

A. Martín del Rey, J. Martín Vaquero, A. Hernández Encinas, A. Queiruga Dios, G. Rodríguez Sánchez, *A method for malware propagation in industrial critical infrastructures*, *Integr. Comput.-Aided Eng.* 23 (2016), 255-268.

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PROYECTOS RELEVANTES

MAGERAN: "Mathematical models in network security against emergent cyber-threats". Grant TIN2017-84844-C2-2-R, MINECO-Spain (Programa Estatal de I+D+i Orientado a los Retos de la Sociedad): 2018-2020.

MASEDECID: "Mathematical models in Security, Defense and Cyber Defense: Design and Computational Implementation". Grant SA054G18, Consejería de Educación, Junta de Castilla y León, Spain: 2018-2020.

Rules\_Math: "New Rules for assessing Mathematical Competencies". Grant 2017-1-ES01-KA203-038491, European Union (Eras2mus+ Programme): 2017-2020.