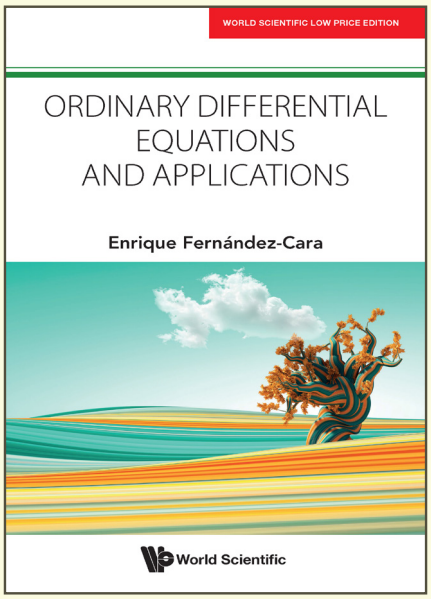
# Ordinary Differential Equations and Applications




By **Enrique Fernández-Cara**
*(University of Seville, Spain)*

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## ABOUT THE BOOK

Differential equations can bring mathematics to life, describing phenomena originating in physics, chemistry, biology, economics, and more. Used by scientists and engineers alike, differential equations are also the starting point of much purely mathematical activity. They also play a role in the formulation and resolution of problems in harmonic analysis, differential geometry, and probability calculus. A large part of functional analysis has therefore been motivated by the need to solve questions in the analysis of differential systems, as with numerical analysis.

Differential equations are doubly relevant, then: as significant in many areas of mathematics, and as important machinery for applying mathematics to real-world problems. This book therefore aims to provide a rigorous introduction to the theoretical study of differential equations, and to demonstrate their utility with applications in many fields.

*Ordinary Differential Equations and Applications* originates from several courses given by the author for decades at the University of Seville. It aims to bring together rigorous mathematical theory and the rich variety of applications for differential equations. The book examines many aspects of differential equations: their existence, uniqueness, and regularity, alongside their continuous dependence on data and parameters. Delving into permanent interpretation of the laws of differential equations, we also look at the role of data and how their solutions behave. Each chapter finishes with a collection of exercises, many of which also contain useful hints.

## READERSHIP

Undergraduate and graduate students, especially those interested by the role played by differential equations in mathematics and science in general.

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## ABOUT THE AUTHOR

**Enrique Fernández-Cara** received his PhD in Mathematics from the University of Sevilla (Spain) and a second in Mathematics from University Paris 6 (France). He has been a scholar, assistant professor, and is currently full professor at the University of Sevilla. He has worked in Sevilla, Paris, Clermont-Ferrand and, more recently, as visiting professor, in several Brazilian universities including UNICAMP in Campinas, UFF in Nitéroi UFBP in Joao Pessoa and UFPE in Recife. He has been the advisor of more than 20 PhD Theses and has participated in more than 20 research projects across Spain, France and Brazil.

His main areas of interest are the theoretical and numerical analysis and control of PDEs, with special emphasis in nonlinear PDEs in physics, biology, and other sciences and some additional questions regarding optimization, stability, inverse problems, etc. In particular, he has considered problems for nonlinear elliptic, parabolic and hyperbolic systems, the homogeneous and nonhomogeneous Navier-Stokes equations, the Oldroyd viscoelastic system and variants, other nonlinear nonscalar systems from tumor growth modelling, etc.

He has contributed to the field with regularity results, new numerical schemes (some of them based on parallelization), new control solution techniques and related applications and numerical simulation. He has published more than 160 papers in various international journals and has attended more than 50 international conferences, most of them related to control and PDEs.


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