



Solving Differential Equations in R (Use R!)

By Karline Soetaert, Jeff Cash, Francesca Mazzia

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This book shows how to solve a variety of differential equations, including ordinary differential equations, initial value problems and boundary value problems, differential algebraic equations, partial differential equations and delay differential equations.

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Bibliography

- Sales Rank: #1444791 in Books
- Published on: 2012-06-07
- Released on: 2012-06-07
- Original language: English
- Number of items: 1
- Dimensions: 9.25" h x .62" w x 6.10" l, .85 pounds
- Binding: Paperback
- 248 pages

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Editorial Review

Review

From the reviews:

“This useful work … focuses on how to numerically solve differential equations. … it will give helpful insight to those who have studied differential equations before and who want to become more knowledgeable about solving them numerically using R, an open-source programming language. … Overall, the book covers the necessary topics for readers to get a good taste of numerically solving differential equations in a variety of applications. Summing Up: Recommended. Upper-division undergraduates, graduate students, and faculty.” (S. L. Sullivan, *Choice*, Vol. 50 (6), February, 2013)

“The book … describes the present stage of development of the R packages intended to solve differential equations. … I strongly recommend the book to all courses in ODE’s and numerical ODE’s … . It can be as well an interesting source of problems for students enabling them to test lectured topics and experiment with new models. … experts in the field can find in the book tasty remarks on the state of the art of numerical methods for differential equations.” (Andrzej Palczewski, *Mathematica Applicanda*, Vol. 41 (1), 2013)

“An invaluable aid for learning almost from scratch about a quite comprehensive collection of types of differential equations, and their implementation in R … . I strongly recommend this work as a companion for most courses on differential equations, as it would enable students to try to implement applications akin to those discussed. Even theoreticians will find a nice review of the history and state of the art of some methods for solving differential equations.” (Arturo Ortiz-Tapia, *ACM Computing Reviews*, October, 2012)

“The book in general deals with the numerical methods implemented to different differential problems. … The main thing that differentiates this book from others is the fact that the authors propose to use for this purpose some non-specific programming environment such as R. … the authors manage to convince the reader about the ability to use this software to solve differential problems. … they show its potential benefits.” (Ivan Secrieru, *Zentralblatt MATH*, Vol. 1252, 2012)

From the Back Cover

Mathematics plays an important role in many scientific and engineering disciplines. This book deals with the numerical solution of differential equations, a very important branch of mathematics. Our aim is to give a practical and theoretical account of how to solve a large variety of differential equations, comprising ordinary differential equations, initial value problems and boundary value problems, differential algebraic equations, partial differential equations and delay differential equations. The solution of differential equations using R is the main focus of this book. It is therefore intended for the practitioner, the student and the scientist, who wants to know how to use R for solving differential equations. However, it has been our goal that non-mathematicians should at least understand the basics of the methods, while obtaining entrance into the relevant literature that provides more mathematical background. Therefore, each chapter that deals with R examples is preceded by a chapter where the theory behind the numerical methods being used is introduced. In the sections that deal with the use of R for solving differential equations, we have taken examples from a variety of disciplines, including biology, chemistry, physics, pharmacokinetics. Many examples are well-known test examples, used frequently in the field of numerical analysis.

About the Author

Karline Soetaert studied Biology and Computer Science at Ghent University (Belgium), where she completed her PhD in Biology in 1989. She is now head of the Ecosystem Studies department at the Netherlands Institute of Sea Research in Yerseke, the Netherlands. She is also a guest professor at the University of Ghent and the Free University of Brussels. In her research she makes frequent use of mathematical models. She has authored over 130 papers in international journals and one book dealing with ecological modeling in R. She is the (co) author of several R-packages on CRAN (deSolve, bvpSolve, ReacTran, rootSolve, deTestSet, limSolve, LIM, ToxLim, NetIndices, FME, shape, diagram, ecolMod, marelac, AquaEnv, BCE).

Jeff Cash received his Mathematics degree from Imperial College, London in 1969 and then moved to St John's college, Cambridge, where he studied for a PhD in the solution of differential equations under the guidance of Dr J.C.P. Miller. Having finished at Cambridge he returned to Imperial College as a member of staff in the Mathematics department and he has stayed there ever since. He was subsequently promoted to reader and then to Professor in Numerical Analysis. His research has been mainly on the solution of difference and differential equations. He has published several codes (MEBDFI, Cash-Karp and TWPBVP) and is the author of more than 100 scientific papers.

Francesca Mazzia earned her undergraduate degree in Computer Science at the University of Bari, Italy and started her scientific career as a research assistant in Numerical Analysis in 1990. In 2000 she was appointed associate professor at the University of Bari. Her research activities mainly concern numerical methods for the solution of ordinary differential equations. She has authored over 50 papers in international journals and is the (co)author of two R packages currently available from CRAN (bvpSolve, deTestSet).

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