METADATA

Title: Numerical integration of differential equations

Other Titles: -

Language: Greek

Authors: Kalogiratou, Z., Professor, UOWM, Monovasilis, T., Professor, UOWM

ISBN: 978-618-228-205-2

Subject: MATHEMATICS AND COMPUTER SCIENCE

Keywords: Numerical Analysis / Ordinary Differential Equations / Single step methods / Runge-Kutta-Nyström / Multistep methods

Bibliographic Reference: Kalogiratou, Z., & Monovasilis, T. (2024). Numerical integration of differential equations [Undergraduate textbook]. Kallipos, Open Academic Editions. http://dx.doi.org/10.57713/kallipos-441

Abstract

This book deals with the numerical integration of Ordinary Differential Equations (ODEs) and it can be used by science and engineering students who have attended an introductory course on numerical analysis. Chapter 1 is a short introduction to numerical methods for ODEs. In Chapter 2 we review background knowledge that will be used in the next chapters. Chapters 3 and 4 concern Runge-Kutta (RK) methods. In particular, an introduction to explicit methods up to the fourth order is given in Chapter 3, and the theory of RK methods as developed by Butcher is given in Chapter 4. Chapter 5 is devoted to Partitioned RK methods and Two-Derivative RK methods. Linear multistep methods (Adams-Bashforth, Adams-Moulton) are reviewed in Chapter 6. The next two chapters deal with second-order ODEs where the first derivative does not appear. Runge-Kutta-Nyström methods are reviewed in Chapter 7 and multistep methods in Chapter 8. Several test problems are presented in Chapter 9. The last 3 chapters (10, 11, 12) introduce the students to current research in the field such as symplectic methods and methods with special properties.

The Project is funded by the National Development Programme 2021-2025 of the Ministry of Education and Religious Affairs and implemented by the Special Account for Research Funds of the National Technical University of Athens.