



Quasilinearization approach to nonlinear problems in physics with application to nonlinear ODEs

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Abstract

The general conditions under which the quadratic, uniform and monotonic convergence in the quasilinearization method of solving nonlinear ordinary differential equations could be proved are formulated and elaborated. The generalization of the proof to partial differential equations is straight forward. The method, whose mathematical basis in physics was discussed recently by one of the present authors (VBM), approximates the solution of a nonlinear differential equation by treating the nonlinear terms as a perturbation about the linear ones, and unlike perturbation theories is not based on the existence of some kind of a small parameter.

It is shown that the quasilinearization method gives excellent results when applied to different nonlinear ordinary differential equations in physics, such as the Blasius, Duffing, Lane–Emden and Thomas–Fermi equations. The first few quasilinear iterations already provide extremely accurate and numerically stable answers. © 2001 Elsevier Science B.V. All rights reserved.

MSC: 02.30.Mv; 04.25.Nx; 11.15.Tk

1. Introduction

In a series of recent papers [1,2], the possibility of applying a very powerful approximation technique called the quasilinearization method (QLM) to physical problems has been discussed. The QLM is designed to confront the nonlinear aspects of physical processes. The method, whose iterations are constructed to yield rapid convergence and often monotonicity, was originally introduced forty years ago by Bellman and Kalaba [3,4] as a generalization of the Newton–Raphson method [5,6] to solve individual or systems of nonlinear ordinary and partial differential equations. Modern developments and applications of the QLM to different fields are given in a monograph [7].

However, the QLM was never systematically studied or extensively applied in physics, although references to it can be found in well-known monographs [8,9] dealing with the variable phase approach to potential scattering, as well as in a few scattered research papers [10–13]. The reason for the sparse use of the QLM in Physics is that the convergence of the method has been proven only under rather restrictive conditions [3,4], which generally

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Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics

L Cohen



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Table of Contents Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics

1. Understanding the eBook Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - The Rise of Digital Reading Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - Advantages of eBooks Over Traditional Books
2. Identifying Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - User-Friendly Interface
4. Exploring eBook Recommendations from Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - Personalized Recommendations
 - Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics User Reviews and Ratings

- Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics and Bestseller Lists
- 5. Accessing Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics Free and Paid eBooks
 - Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics Public Domain eBooks
 - Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics eBook Subscription Services
 - Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics Budget-Friendly Options
- 6. Navigating Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics eBook Formats
 - ePub, PDF, MOBI, and More
 - Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics Compatibility with Devices
 - Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - Highlighting and Note-Taking Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - Interactive Elements Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
- 8. Staying Engaged with Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
- 9. Balancing eBooks and Physical Books Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - Setting Reading Goals Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics
 - Fact-Checking eBook Content of Quasilinearization And Nonlinear Problems In Fluid And Orbital Mechanics

- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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web dec 15 2020 solar circuit a solar charging circuit is a circuit that gets higher voltage from the solar panel and converts it down to a charging voltage so that it can efficiently charge the battery for this project we will be using the lt3562 based mppt charge controller circuit board that we have already made in one of our previous projects

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web dec 16 2019 the scc is designed based on the arduino microcontroller which has the role of controlling the circuit and producing pwm signals to regulate the dc dc converter several tests were conducted to validate the efficiency of the mppt algorithm the scc device succeeded in increasing efficiency up to 52 on the low irradiance level