

## Numerical Methods Lecture 5 - Curve Fitting Techniques

### Topics

- motivation
- interpolation
- linear regression
- higher order polynomial form
- exponential form

### Curve fitting - motivation

For root finding, we used a given function to identify where it crossed zero  
 where does  $f(x) = 0$  ??

Q: Where does this given function  $f(x)$  come from in the first place?

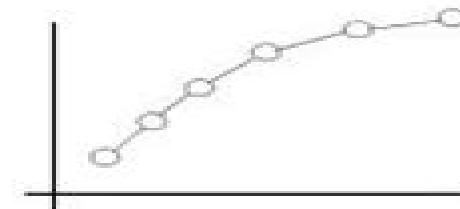
- Analytical models of phenomena (e.g. equations from physics)
- Create an equation from observed data

### 1) Interpolation (connect the data-dots)

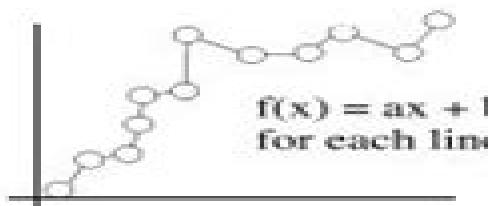
If data is reliable, we can plot it and connect the dots  
 This is piece-wise, linear interpolation

This has limited use as a general function  $f(x)$

Since it's really a group of small  $f(x)$ 's, connecting one point to the next  
 it doesn't work very well for data that has built in random error (scatter)



### 2) Curve fitting - capturing the trend in the data by assigning a single function across the entire range. The example below uses a straight line function



A straight line is described generically by  $f(x) = ax + b$

The goal is to identify the coefficients "a" and "b" such that  $f(x)$  "fits" the data well

# Numerical Methods Of Curve Fitting

**K. Akbar Ansari, Bonni Dichone**

## Numerical Methods Of Curve Fitting:

**Numerical Methods of Curve Fitting** P. G. Guest, Philip George Guest, 2012-12-13 This 1961 book provides information on the methods of treating series of observations the field covered embraces portions of both statistics and numerical analysis

*Numerical Methods of Curve Fitting* Philip George Guest, 2003-01 **Numerical Methods of Curve Fitting** Paul Gordon Guest, 1961

*Numerical Methods for Non-linear Least Squares Curve Fitting* Derald Dee Walling, 1963 **A Least-square Distance Curve-fitting Technique** John Q. Howell, 1971

*Numerical Methods for Experimental Mechanics* Donald Berghaus, 2013-11-27 The purpose of this book is to place a resource in the hands of experimental mechanics researchers to enable them to understand and to obtain a working familiarity with certain of the numerical methods particularly useful to the field. The book is organized to permit readers to study the methods and to observe their application in experimental problems. It is also intended to encourage readers to directly apply the methods to the same problems or to similar problems of their choosing. To this end computer programs are available electronically together with data for easy application. Program listings are given in the appendix. There are four chapters which make up the central coverage of the text. The first of these deals with least square methods of problem solution both for curve fitting and for general solution of overdetermined problems. Nonlinear least squares methods are included. Secondly splines specifically smoothed splines are covered including specification of boundary conditions for the latter. Use for differentiation is emphasized with attention to control of possible excesses in smoothing. Transform methods are the third major area covered both the Discrete Fourier Transform and the Fast Fourier Transform. Their combined use is described for appropriate problems. Finally digital filters are included principally the Butterworth low pass filter. Coverage also includes different filter orders high pass filters and the two pass filter technique. The author has had experience with the four areas covered and with all of the example problems described in the text.

*Applied Numerical Methods Using MATLAB* Won Y. Yang, Wenwu Cao, Jaekwon Kim, Kyung W. Park, Ho-Hyun Park, Jingon Joung, Jong-Suk Ro, Han L. Lee, Cheol-Ho Hong, Taeho Im, 2020-05-12 This new edition provides an updated approach for students, engineers and researchers to apply numerical methods for solving problems using MATLAB. This accessible book makes use of MATLAB software to teach the fundamental concepts for applying numerical methods to solve practical engineering and/or science problems. It presents programs in a complete form so that readers can run them instantly with no programming skill, allowing them to focus on understanding the mathematical manipulation process and making interpretations of the results. *Applied Numerical Methods Using MATLAB* Second Edition begins with an introduction to MATLAB usage and computational errors, covering everything from input/output of data to various kinds of computing errors and on to parameter sharing and passing and more. The system of linear equations is covered next, followed by a chapter on the interpolation by Lagrange polynomial. The next sections look at interpolation and curve fitting, nonlinear equations, numerical differentiation, integration, ordinary differential equations and optimization. Numerous methods such as

the Simpson Euler Heun Runge kutta Golden Search Nelder Mead and more are all covered in those chapters The eighth chapter provides readers with matrices and Eigenvalues and Eigenvectors The book finishes with a complete overview of differential equations Provides examples and problems of solving electronic circuits and neural networks Includes new sections on adaptive filters recursive least squares estimation Bairstow s method for a polynomial equation and more Explains Mixed Integer Linear Programming MILP and DOA Direction of Arrival estimation with eigenvectors Aimed at students who do not like and or do not have time to derive and prove mathematical results Applied Numerical Methods Using MATLAB Second Edition is an excellent text for students who wish to develop their problem solving capability without being involved in details about the MATLAB codes It will also be useful to those who want to delve deeper into understanding underlying algorithms and equations

**Numerical Methods** Prof. K. Sambaiah,2020-07-02 One of the important features of this book lies in introducing the procedures like algorithms to implement each of the numerical method were given in the book Also some shortcut methods have been given to solve the boundary value problems Many examples have been given in the chapters to inculcate the concepts of numerical methods in the students This book is useful the students of B Sc M Sc B Tech M Tech and research scholars In this book we discussed types of errors interpolation numerical differentiation numerical integration numerical solutions of differential equation curve fitting approximation of functions methods of solving algebraic and transcendental equations and their convergence solution of system of linear equations Further the different methods of finding the eigen values and eigen vectors of a matrix have been discussed The solutions of difference equations have been discussed Finally the solutions of boundary value problems have been discussed and short cut methods are introduced to solve boundary value problems

**Numerical Techniques of Curve Fitting Using Orthogonal Polynomials** James Paul Sharkey,1970 **Mine Planning and Equipment Selection 1995** J. Hadjigeorgiou,A.K. Mehmotra,R. Poulin,R.K. Singhal,1995-10-31 This text presents about 150 papers based on an international symposium on mine planning and equipment selection held in Canada in 1995 Coverage includes design and planning of surface and underground mines surface mining and the environment tailings disposal and slope stability analysis

**A Method of Curve Fitting** S. Krichewsky,1922 **Computer Methods for Engineering with MATLAB Applications** Yogesh Jaluria,2011-09-08 Substantially revised and updated Computer Methods for Engineering with MATLAB Applications Second Edition presents equations to describe engineering processes and systems It includes computer methods for solving these equations and discusses the nature and validity of the numerical results for a variety of engineering problems This edition now

**Advanced Engineering Mathematics** Dennis G. Zill,Warren S. Wright,2014 Modern and comprehensive the new Fifth Edition of Zill s Advanced Engineering Mathematics Fifth Edition provides an in depth overview of the many mathematical topics required for students planning a career in engineering or the sciences A key strength of this best selling text is Zill s emphasis on differential equations as mathematical models discussing the constructs and pitfalls of each The Fifth Edition is

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**Advanced Engineering Mathematics - Book Alone** Dennis G. Zill, Warren S. Wright, 2012-10-01 *An Introduction to Numerical Methods Using MATLAB* K. Akbar Ansari, Bonni Dichone, 2019 *An Introduction to Numerical Methods using MATLAB* is designed to be used in any introductory level numerical methods course. It provides excellent coverage of numerical methods while simultaneously demonstrating the general applicability of MATLAB to problem solving. This textbook also provides a reliable source of reference material to practicing engineers scientists and students in other junior and senior level courses where MATLAB can be effectively utilized as a software tool in problem solving. The principal goal of this book is to furnish the background needed to generate numerical solutions to a variety of problems. Specific applications involving root finding, interpolation, curve fitting, matrices, derivatives, integrals, and differential equations are discussed and the broad applicability of MATLAB demonstrated. This book employs MATLAB as the software and programming environment and provides the user with powerful tools in the solution of numerical problems. Although this book is not meant to be an exhaustive treatise on MATLAB, MATLAB solutions to problems are systematically developed and included throughout the book. MATLAB files and scripts are generated and examples showing the applicability and use of MATLAB are presented throughout the book. Wherever appropriate the use of MATLAB functions offering shortcuts and alternatives to otherwise long and tedious numerical solutions is also demonstrated. At the end of every chapter a set of problems is included covering the material presented. A solutions manual to these exercises is available to instructors.

**Practical Numerical Analysis Using Microsoft Excel** A. Nandy, 2004 *This text presents numerical analysis in an easy and lucid manner requiring no prior knowledge of computer programming or intricacies of mathematics using MS EXCEL 2000 through built in functions of MS Excel depicting with ease various analysis. The analysis used can also be done using earlier versions of MS Excel. The majority of numerical analysis needs fall into the curve fitting, interpolation, solutions of equations, integration methods. For these Excel's features*

provide a very easy and inexpensive way to get the job done     **4th European Conference of the International Federation for Medical and Biological Engineering 23 - 27 November 2008, Antwerp, Belgium** Jos van der Sloten,Pascal Verdonck,Marc Nyssen,Jens Haueisen,2009-02-04 The 4th European Congress of the International Federation for Medical and Biological Federation was held in Antwerp November 2008 The scientific discussion on the conference and in this conference proceedings include the following issues Signal Image Processing ICT Clinical Engineering and Applications Biomechanics and Fluid Biomechanics Biomaterials and Tissue Repair Innovations and Nanotechnology Modeling and Simulation Education and Professional     **Advanced Engineering Mathematics** Dennis Zill,Warren S. Wright,2011 Accompanying CD ROM contains a chapter on engineering statistics and probability by N Bali M Goyal and C Watkins CD ROM label     **Practical Curve Fitting and Data Analysis** Joseph H. Noggle,1993 This guide focuses on how to make graphs and abstract physical information from data using a personal computer This tutorial program book package covers the elements of curve fitting and statistical treatment of data and numerical analysis Taking a step by step approach the book the program and the accompanying data files are designed to demonstrate common errors and pitfalls It contains examples from analytical chemistry chemical engineering and biochemistry For those engineers and or scientists who want to easily make graphs and plot physical information from data with a microcomputer     **Numerical Methods in "C"** J.G. Kori,2006

## Unveiling the Magic of Words: A Review of "**Numerical Methods Of Curve Fitting**"

In some sort of defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their capability to kindle emotions, provoke contemplation, and ignite transformative change is actually awe-inspiring. Enter the realm of "**Numerical Methods Of Curve Fitting**," a mesmerizing literary masterpiece penned by a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve into the book's central themes, examine its distinctive writing style, and assess its profound impact on the souls of its readers.

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