

Quest for Research Excellence On Computing, Mathematics and Statistics

Editors

Kor Liew Kee

Kamarul Ariffin Mansor

Asmahani Nayan

Shahida Farhan Zakaria

Zanariah Idrus

**Quest for Research Excellence on Computing,
Mathematics and Statistics**

Chapters in Book

The 2nd International Conference on Computing, Mathematics
and Statistics (iCMS2015)

Editors:

Kor Liew Lee
Kamarul Ariffin Mansor
Asmahani Nayan
Shahida Farhan Zakaria
Zanariah Idrus



**Quest for Research Excellence on Computing,
Mathematics and Statistics**

Chapters in Book

The 2nd International Conference on Computing, Mathematics and Statistics
(iCMS2015)

4-5 November 2015
Langkawi Lagoon Resort
Langkawi Island, Kedah
Malaysia

Copyright © 2015 Universiti Teknologi MARA Cawangan Kedah

All rights reserved, except for educational purposes with no commercial interests. No part of this publication may be reproduced, copied, stored in any retrieval system or transmitted in any form or any means, electronic or mechanical including photocopying, recording or otherwise, without prior permission from the Rector, Universiti Teknologi MARA Cawangan Kedah, Kampus Merbok, 08400 Merbok, Kedah, Malaysia.

The views and opinions and technical recommendations expressed by the contributors are entirely their own and do not necessarily reflect the views of the editors, the Faculty or the University.

Publication by
Faculty of Computer & Mathematical Sciences
UiTM Kedah

ISBN 978-967-0314-26-6

Content

International Scientific Committee

Preface

CHAPTER 1	1
Towards Ameliorating the Problem of Packet Dropping in IDS using P System Model on GPU <i>Rufai Kazeem Idowu, Ravie Chandren M., and Zulaiha Ali Othman</i>	
CHAPTER 2	11
Analyses of Software Testing Problems in Small and Medium Software Enterprises (SME's) and a Proposed Framework on Exploratory Testing <i>Murugan Thangiah and Shuib Basri</i>	
CHAPTER 3	25
Senior Citizen and Online Form: Hybrid Guideline Form Design <i>Zanariah Idrus, Nor Hafizah Abdul Razak, and Noor Hasnita Abdul Talib</i>	
CHAPTER 4	35
Research Paradigms in Computing Disciplines: A Review <i>Nor Hafizah Abdul Razak, Noor Hasnita Abdul Talib, and Jasmin Ilyani Ahmad</i>	
CHAPTER 5	41
Dijkstra's Algorithm In Product Searching System (Prosearch) <i>Nur Hasni Nasrudin, Siti Hajar Nasaruddin, Syarifah Syafiqah Wafa Syed Abdul Halim and Rosida Ahmad Junid</i>	
CHAPTER 6	49
Developing Waqf Land Computing: A Preliminary Study On The Used Of Web-based Applications And Spatial Database <i>Siti Nurbaya Ismail, Zanariah Idrus, Nor Hafizah Abdul Razak</i>	

CHAPTER 7	59
Implementation Of CORDIC Algorithm In Vectoring Mode <i>Anis Shahida Mokhtar, Abdullah bin Mohd Fadzullah</i>	
CHAPTER 8	71
A Description of Projective Contractions in the Orlicz-Kantorovich Lattice <i>Inomjon Ganiev and M. Azram</i>	
CHAPTER 9	83
The Geometry of the Accessible Sets of Vector Fields <i>A.Y.Narmanov, and I. Ganiev</i>	
CHAPTER 10	89
Existence Result of Third Order Functional Random Integro-Differential Inclusion <i>D. S. Palimkar</i>	
CHAPTER 11	105
Fourth Order Random Differential Equation <i>D. S. Palimkar and P.R. Shinde</i>	
CHAPTER 12	115
New Concept of e - I -open and e - I -Continuous Functions <i>W.F. Al-omeri, M.S. Md. Noorani, and A. AL-Omari</i>	
CHAPTER 13	123
Visualization of Constrained Data by Rational Cubic Ball Function <i>Wan Zafira Ezza Wan Zakaria, and JamaludinMd Ali</i>	
CHAPTER 14	133
Octupole Vibrations in Even–Even Isotopes of Dy <i>A.A. Okhunov, G.I. Turaeva, and M. Jahangir Alam</i>	
CHAPTER 15	141
Characterization of p -Groups with a Maximal Irredundant 10-Covering <i>Rawdah Adawiyah Tarmizi and Hajar Sulaiman</i>	

CHAPTER 16	149
Sensitivity Index of HIV-1 model Parameters with Vertical transmission	
<i>Amiru Sule, Mamman Mamuda, Abdullahi Mohammed Baba, Jibril Lawal, and I.G. Usman</i>	
CHAPTER 17	163
Derivation of Four-Point Explicit Block Methods for Direct Solution of Initial Value Problems of Third Order Ordinary Differential Equations	
<i>Z. Omar, J. O. Kuboye, and Y.A. Abdullah</i>	
CHAPTER 18	175
Absolute Translativity of Generalized Nörlund Mean	
<i>Amjed Zraiqat</i>	
CHAPTER 19	189
Type I Error of the Modified Wilcoxon Signed Rank Test under Leptokurtic Distribution	
<i>Nor Aishah Ahad, Sharipah Soaad Syed Yahaya, Suhaida Abdullah, Lim Yai Fung and Zahayu Md Yusof</i>	
CHAPTER 20	199
The Combined EWMA-CUSUM Control Chart with Autocorrelation	
<i>Abbas Umar Farouk, and Ismail Bin Mohamad</i>	
CHAPTER 21	213
Estimating Philippine Dealing System Treasury (PDST) Reference Rate Yield Curves using a State-Space Representation of the Nelson-Siegel Model	
<i>Len Patrick Dominic M. Garces, and Ma. Eleanor R. Reserva</i>	
CHAPTER 22	225
A Structural Equation Model Analyzing the Relationship Model on Perception Students toward Mathematics	
<i>Siti Fairus Mokhtar</i>	

CHAPTER 23	233
Partial Least Squares Based Financial Distressed Classifying Model of Small Construction Firms	
<i>Amirah-Hazwani Abdul Rahim, Ida-Normaya M. Nasir, Abd-Razak Ahmad, and Nurazlina Abdul Rashid</i>	
CHAPTER 24	245
Logit Bankruptcy Model of Industrial Product Firms	
<i>Asmahani Nayan, Siti-Shuhada Ishak, and Abd-Razak Ahmad</i>	
CHAPTER 25	255
Data Mining in Predicting Firms Failure: A Comparative Study Using Artificial Neural Networks and Classification and Regression Tree	
<i>Norashikin Nasaruddin, Wan-Siti-Esah Che-Hussain, Asmahani Nayan, and Abd-Razak Ahmad</i>	
CHAPTER 26	265
Risks of Divorce: Comparison between Cox and Parametric Models	
<i>Sanizah Ahmad, Norin Rahayu Shamsuddin, Nur Niswah Naslina Azid @ Maarof, and Hasfariza Farizad</i>	
CHAPTER 27	277
Reliability and Construct Validity of DASS 21 using Malay Version: A Pilot Study	
<i>Kartini Kasim, Norin Rahayu Shamsuddin, Wan Zulkipli Wan Salleh, Kardina Kamaruddin, and Norazan Mohamed Ramli</i>	
CHAPTER 28	285
Outlier Detection in Time Series Model	
<i>Nurul Sima Mohamad Shariff, Nor Aishah Hamzah, and Karmila Hanim Kamil</i>	
CHAPTER 29	297
ROAD Algorithm for Control Charts	
<i>Gejza Dohnal</i>	

CHAPTER 30	311
Learning Numerals for Down Syndrome by applying Cognitive Principles in 3D Walkthrough	
<i>Nor Intan Shafini Nasaruddin, Khairul Nurmazianna Ismail, and Aleena Puspita A.Halim</i>	
CHAPTER 31	329
Predicting Currency Crisis: An Analysis on Early Warning System from Different Perspective	
<i>Nor Azuana Ramli</i>	
CHAPTER 32	341
Using Analytic Hierarchy Process to Rank Takaful Companies based on Health Takaful Product	
<i>Noor Hafizah Zainal Aznam, Shahida Farhan Zakaria, and Wan Asma 'a Wan Abu Bakar</i>	
CHAPTER 33	349
Service Discovery Mechanism for Service Continuity in Heterogeneous Network	
<i>Shaifizat Mansor, Nor Shahniza Kamal Basha, Siti Rafidah Muhamat Dawam, Noor Rasidah Ali, and Shamsul Jamel Elias</i>	
CHAPTER 34	361
Ranking Islamic Corporate Social Responsibility Activities under Product Development Theme using Analytic Hierarchy Process	
<i>Shahida Farhan Zakaria, Wan-Asma ' Wan-Abu-Bakar, Roshima Said, Sharifah Nazura Syed-Noh, and Abd-Razak Ahmad</i>	
CHAPTER 35	369
A Fuzzy Rule Base System For Mango Ripeness Classification	
<i>Ab Razak Mansor, Mahmud Othman, Noor Rasidah Ali , Khairul Adilah Ahmad, and Samsul Jamel Elias</i>	

CHAPTER 36.....381

**Technology Assistance for Kids with Learning Disabilities:
Challenges and Opportunities**

*Suhailah Mohd Yusof, Noor Hasnita Abdul Talib, and Jasmin Ilyani
Ahmad*

CHAPTER 13

Visualization of Constrained Data by Rational Cubic Ball Function

Wan Zafira Ezza Wan Zakaria, and JamaludinMd Ali

Abstract. The main purpose of this paper is the construction of shape preserving interpolation for visualization of constrained data that will be smooth and pleasant. Three shape parameters are introduced in order to control the shape of the interpolation. The rational cubic Ball function is constructed according to the shape of the data that are constraint between two lines using appropriate conditions on each of the shape parameters. Numerical examples are provided to demonstrate that the anticipated scheme is interactive and smooth.

Keywords: shape preserving interpolation; constrained data; rational cubic Ball function; shape parameters.

Wan Zafira Ezza Wan Zakaria (✉)
School of Industrial Technology, Universiti Sains Malaysia, 11800, Penang
e-mail: ezzafira@usm.my

JamaludinMd Ali
School of Mathematical Science, Universiti Sains Malaysia, 11800, Penang
jamaluma.cs@usm.my

1 Introduction

Shape preserving interpolation is an important tool in Computer Graphics, Computer Aided Geometric Design and Engineering as well as for data visualization. The main goal of data visualization is a graphical representation of information in an effective and clear way [5]. Some shape preserving interpolating scheme arises which not only maintain the shape of the input data but also pay heed to the underlying smoothness of curve. This motivates us to come up with the scheme that can preserve the constrained curve that lies above or below a line. In this work another interpolating scheme is also developed which is not only preserves the constrained curve that lies above or below the line but also between two lines. Many authors have worked in the area of shape preservation, such as curve interpolation, which preserves the shape of data using rational cubic interpolation. Most of them concentrated on the problem of positivity, monotonicity and convexity preserving interpolating scheme [1-2]. Only a few authors considered the problem of shape preserving and constrained data visualization using rational cubic Ball interpolation. While some of them use other different scheme for constrained data visualization [3-4].

In this paper, we have developed a smooth rational cubic Ball function with three shape parameters in its description to preserve the shape of constrained curve with data lying above or below the line and between two lines. The curve is then generated using this modified interpolation function as demonstrated in the numerical demonstration.

2 Rational Cubic Ball Interpolation

Let $\{(x_i, f_i), i = 1, 2, \dots, n\}$ be a given data points, $x_1 < x_2 < \dots < x_n$ and f_1, f_2, \dots, f_n are real numbers. Suppose $h_i = x_{i+1} - x_i$ and $\Delta_i = \frac{f_{i+1} - f_i}{h_i}$ for $i = 1, 2, \dots, n-1$, a piecewise rational cubic Ball function $S(x), x \in [x_i, x_{i+1}]$, $i = 1, 2, \dots, n-1$ with local variable $\theta = \frac{x_{i+1} - x_i}{h_i}$ for $\theta \in [0, 1]$ is defined as

$$S(x) \equiv s_i = \frac{p_i(\theta)}{q_i(\theta)} = \frac{(1-\theta)^2 u_i a_i + 2(1-\theta)^2 \theta a_1 + 2(1-\theta)\theta^2 a_2 + \theta^3 a_3}{(1-\theta)^2 u_i + 2(1-\theta)\theta u_i v_i w_i + \theta^2 v_i} \quad (1)$$

With the initial and end conditions,

$$\begin{aligned} S(x_i) &= f_i, & S(x_{i+1}) &= f_{i+1} \\ S'(x_i) &= d_i, & S'(x_{i+1}) &= d_{i+1} \end{aligned} \quad (2)$$

Here S' denotes the derivative with respect to x and d_i, d_{i+1} denotes the derivative value at x_i and x_{i+1} respectively. We should note that the derivatives can be provided by the users or can be computed using the method proposed by [6] from the data set itself.

From Eqn. (1) and Eqn. (2) a_i , are obtained as follows

$$\begin{aligned} a_0 &= u_i f_i, & a_1 &= \frac{1}{2} u_i (d_i h_i + 2v_i w_i f_i) \\ a_2 &= \frac{1}{2} v_i (d_{i+1} h_i - 2u_i w_i f_{i+1}), & a_3 &= v_i f_{i+1} \end{aligned}$$

3 Constrained Curve Visualization

Let $\{(x_i, f_i), i=1,2,\dots,n\}$ be a given data set lying above the straight line $y = mx_i + c$ i.e.

$$f_i > mx_i + c, \quad \forall i = 0,1,2,\dots,n. \quad (3)$$

Where m and c is the slope and the y-intercept of the line respectively.

The curve of the of the given set of data points lies above the straight line if the rational cubic Ball function (1) holds the following condition

$$S(x) > y, \quad \forall x \in [x_0, x_n] \quad (4)$$

In each subinterval $I_i = [x_i, x_{i+1}]$, the relation (4) can be expressed as:

$$S_i(x) = \frac{p_i(\theta)}{q_i(\theta)} > mx_i + c. \quad (5)$$

The equation of the straight line in parameter θ is defined as:

$$r_i(1-\theta) + s_i\theta, \quad \theta \in [0,1] \quad (6)$$

where,

$$r_i = mx_i + c \text{ and } s_i = mx_{i+1} + c.$$

The parametric form of the equation (5) is

$$S_i(x) = \frac{p_i(\theta)}{q_i(\theta)} > r_i(1-\theta) + s_i\theta, \quad i = 0, 1, 2, \dots, n. \quad (7)$$

or

$$S_i(x) = \frac{p_i(\theta)}{q_i(\theta)} - r_i(1-\theta) + s_i\theta > 0. \quad (8)$$

Multiply both sides of equation (8) by $q_i(\theta)$, we have

$$F_i(x) = \sum_{k=0}^3 (1-\theta)^{3-k} \theta^k H_{k,i}. \quad (9)$$

where

$$H_{0,i} = u_i (f_i - r_i)$$

$$H_{1,i} = \frac{1}{3} u_i (d_i h_i + 2v_i w_i (f_i - r_i) + f_i - s_i)$$

$$H_{2,i} = \frac{1}{3} v_i (-d_{i+1} h_i + 2u_i w_i (f_{i+1} - s_i) + f_{i+1} - r_i)$$

$$H_{3,i} = v_i (f_{i+1} - s_i).$$

Necessary conditions derived from equation (3) we have:

$$\begin{cases} (f_i - r_i) > 0 \\ (f_{i+1} - s_i) > 0 \end{cases} \quad (10)$$

The polynomial $F_i(x) > 0$ if $H_{k,i} > 0$, $k = 0, 1, 2, 3$.

Since $u_i, v_i > 0$ and from equation (10), we have $H_{0,i} > 0$ and $H_{3,i} > 0$.

$H_{1,i} > 0$ if

$$w_i > -\frac{d_i h_i + f_i - s_i}{2v_i (f_i - r_i)}. \quad (11)$$

$H_{2,i} > 0$ if

$$w_i > \frac{d_{i+1}h_i - (f_{i+1} - r_i)}{2u_i(f_{i+1} - s_i)}. \quad (12)$$

The above results can be summarized as:

Theorem 3.1. The rational cubic Ball function $S(x)$, defined over the each subinterval $I_i = [x_i, x_{i+1}]$ in (1), preserves the shape of data that lies above the straight line, if the following sufficient conditions are satisfied.

$$\left\{ \begin{array}{l} u_i > 0, v_i > 0 \\ w_i > \max \left\{ 0, -\frac{d_i h_i + f_i - s_i}{2v_i(f_i - r_i)}, \frac{d_{i+1}h_i - (f_{i+1} - r_i)}{2u_i(f_{i+1} - s_i)} \right\} \end{array} \right. \quad (13)$$

The above constraints can be written as:

$$\left\{ \begin{array}{l} u_i > 0, v_i > 0 \\ w_i = p_i + \max \left\{ 0, -\frac{d_i h_i + f_i - s_i}{2v_i(f_i - r_i)}, \frac{d_{i+1}h_i - (f_{i+1} - r_i)}{2u_i(f_{i+1} - s_i)} \right\}, p_i > 0 \end{array} \right. \quad (14)$$

In the same manner the same condition given by Equation (14) holds if the line lies above the data points. However if the curve generated has to be constrained between the two lines then the weight has to be the maximum of the two cases.

4 Numerical Demonstration

Consider the sets of data taken at random in Table 1, which lie above the straight line $y = 0.3x$. The data also apply for sets of data that lie below the straight line $y = 1.4x + 60.5$. Fig. 1. drawn with the rational cubic Ball function without any constrained data. On the other hand, Fig. 2. and Fig. 3. when drawn by the constrained rational cubic Ball interpolation preserves the shape of constrained data lying above and below the line respectively. Fig. 4. show more clearly constrained curve obtained by constrained data lie both above and below the straight line in one interpolation. A remarkable

difference in smoothness with a visually pleasant view can be seen in these figures due choice on the values of shape parameter given to the designer.

Table 4. A set of data taken by random.

i	x_i	y_i
1	0	5.5
2	2	5.5
3	3	5.5
4	5	5.5
5	6	5.5
6	8	5.5
7	11	9.6
8	12	50
9	14	60
10	15	80
11	16.8	80
12	17	84
13	20	85

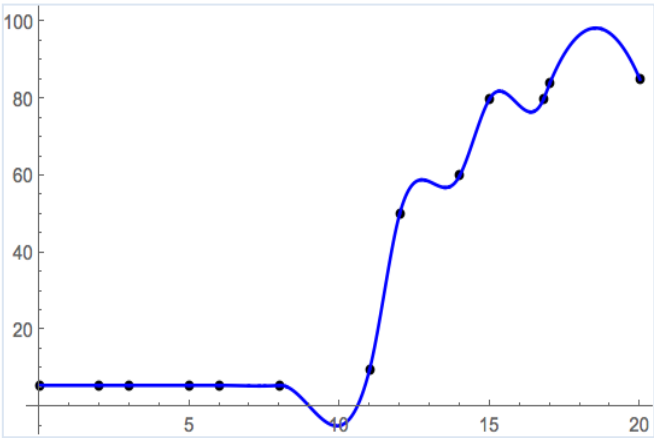


Fig. 2. Rational cubic Ball function without any constrained data.

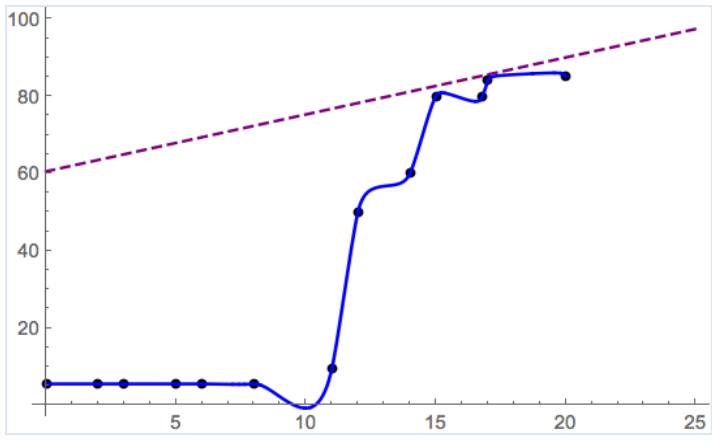


Fig. 3. Constrained data lie above the straight line.

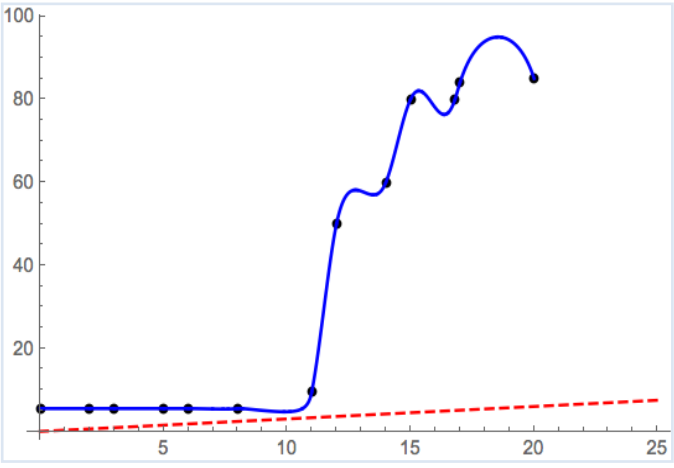


Fig. 4. Constrained data lie below the straight line.

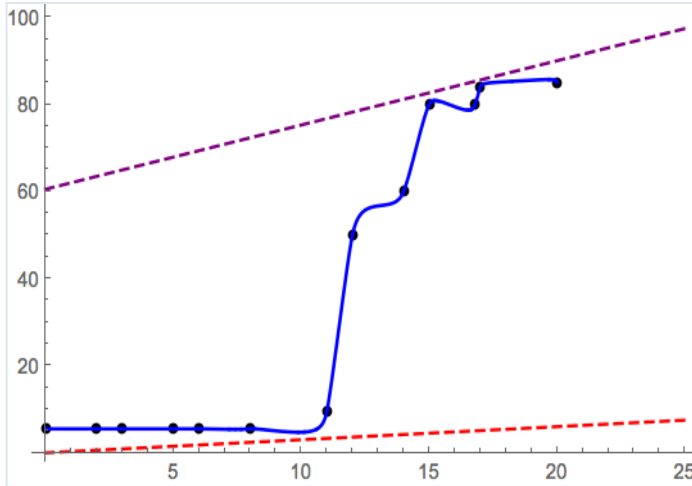


Fig. 5. Combination of Constrained data lie below and above the straight line.

Acknowledgements

Our appreciation goes to the School of Industrial Technology and School of Mathematical Sciences, Universiti Sains Malaysia for supporting this research and financial support to attend the conference.

References

1. Jaafar, W.N.W., Abbas, M., Rahim, A.R.M., Piah: Shape Preserving Visualization of Monotone data using a rational cubic Ball function. *ScienceAsia*. 40s, 40-46(2014)
2. Jaafar, W.N.W., Abbas, M., Rahim, A.R.M.: Shape preserving rational cubic Ball interpolation for positive data. In: 21st National Symposium on Mathematical Sciences (SKSM21), pp. 325-331. AIP Publishing, Penang, Malaysia (2014)
3. Awang, M.N.H., Abbas, M., Majid, A.A., Ali, J.M.: Data visualization for Constrained Data using C^2 Rational Cubic Spline. In: Proceedings of the World Congress on Engineering and Computer Science, pp. 978-988. San Francisco, USA (2013)

4. Shaikh, T.S., Sarfaz, M., Hussain, M.Z.: Shape Preserving Constrained Data Visualization for visualization using Rational Functions. *Journal of Prime Research in Mathematic*. 7, 35-51 (2011)
5. Abbas, M., Majid, A.A., Awang, M.N.H., Ali, J.M.: Constrained Shape Preserving Rational Bi-Cubic Spline Interpolation. *World Sciences Journal*. 20(6), 790-800 (2012)
6. Ali, J.M., Hassan, H.M., Ahmad, A.H.: Visualize Scientific Data using Rational Cubic. In: *Regional Conference on Ecological and Environment Modeling (ECOMOD)*, pp. 211-220. Penang, Malaysia (2004)



ISBN 978-967-0314-25-6



9 789670 314256