



Dispersion Relation Equation
of Shallow Water

Solution of Fisher's Equation
Using Integral Iterative Method

Covid-19 and Political Crisis
Effects on Risk Minimising
Portfolios

Determinants
of Graduate
Starting Salary

Applications of Institutionistic Fuzzy Analytic
Hierarchy Process

MATHEMATICS

IN APPLIED RESEARCH

BULETIN RASMI
KOLEJ PENGAJIAN PENGKOMPUTERAN,
INFORMATIK, DAN MEDIA, UITM CAWANGAN
NEGERI SEMBILAN KAMPUS SEREMBAN
EDISI NOVEMBER 2022

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Persiaran Seremban Tiga/1, Seremban 3,
70300 Seremban, Negeri Sembilan,
MALAYSIA.

Tel: +606 634 2000, Faks: +606 633 5813

eISSN: 2811-4027

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Semenjak tahun 2014, mahasiswa tahun akhir KPIM (sebelumnya dikenali FSKM) Seremban telah menghasilkan banyak penyelidikan yang berpotensi untuk diketengahkan dalam dunia akademik. Akan tetapi tidak banyak yang berjaya diterbitkan dalam jurnal atau pun prosiding konferensi akademik kerana halangan tertentu seperti kualiti penyelidikan dan penulisan ilmiah. Oleh itu, penerbitan makalah ini diharapkan dapat menambahkan lagi ruang bagi penerbitan hasil penyelidikan warga KPIM Seremban.

Disamping itu, pihak KPIM Seremban mengharap makalah ini akan menjadi rujukan dan pemangkin kepada usaha menghasilkan penyelidikan Projek Tahun Akhir yang lebih bermutu tinggi. Makalah ini juga adalah batu asas kepada perkongsian penyelidikan terkini daripada pelajar dan pensyarah KPIM Seremban.

Bagi pihak editorial, saya mengucapkan Syabas dan tahniah kepada pasukan penerbitan yang berusaha keras untuk menghasilkan makalah Mathematics in Applied Research. Saya juga ingin mengambil kesempatan ini untuk menyampaikan ucapan terima kasih khas buat dua editor yang akan meninggalkan kita untuk bersara iaitu;

- Profesor Madya Dr. Nur Azlina Abd Aziz
- Dr. Nor Azni Shahari

semoga kecemerlangan perkhidmatan yang ditunjukkan oleh kedua editor-editor ini akan menjadi pendorong kepada editorial board yang seterusnya. Sekian. Terima kasih.

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for all the dedications and

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MATHEMATICS IN APPLIED RESEARCH
Volume 3 (2022)

Kolej Pengajian Pengkomputeran, Informatik dan Media
Universiti Teknologi MARA Cawangan Negeri Sembilan

Contents

RISK MINIMIZATION FOR A PORTFOLIO USING MEAN ABSOLUTE DEVIATION AND CONDITIONAL VALUE-AT-RISK <i>Iylia Lyiana Rahim, Mohd Azdi Maasar, Siti Ayuni Mohd Jamil, and Nur Anis Mohd Aziz</i>	1
FORECAST THE PROFITABILITY OF ISLAMIC BANKS IN MALAYSIA BASED ON ISLAMIC INTERBANK RATE <i>Husnul Adib bin Muhamad Amin, Muhammad Alif bin Izani, Ahmad Aqil bin Ahmad Azam, Muhammad Hazim bin Nordin and Nur Amalina Shafie</i>	5
COVID-19 AND POLITICAL CRISIS EFFECTS ON RISK MINIMISING PORTFOLIO FOR MALAYSIA'S STOCK MARKETS USING MEAN-CVAR OPTIMIZATION MODEL <i>Amera Katrina Kornain, Mohd Azdi Maasar, Nur Aisyah Nadhirah Ismanazir ,and Najwa Roseli</i>	9
DISPERSION RELATION EQUATION OF SHALLOW WATER: WAVELENGTH ESTIMATOR <i>Nor Azni Shahari, Maizatur Najihah Azlan, Siti Nuramyra Mohd Abd Razak and Nurain Nadhirah mohamad</i>	13
ROOT FINDING FOR NON LINEAR EQUATION BASED ON IMPROVEMENT NEWTON'S METHOD <i>Nor Azni Shahari, Maizatur Najihah Azlan, Siti Nuramyra Mohd Abd Razak and Nurain Nadhirah mohamad</i>	18
NUMERICAL APPROXIMATION OF BLASIUS EQUATION USING DAFTARDAR-GEJJI AND JAFARI METHOD <i>Mat Salim Selamat, Siti Maisarah Ramli, Rafika Rasuli and Nadia Mohamad</i>	23
AN INTUITIONISTIC FUZZY ANALYTIC HIERARCHICAL PROCESS (IFAHP) APPROACH IN SOLVING THE MARKETING PLATFORM SELECTION PROBLEM <i>Nor Faradilah Mahad, Nur Aishah Mohd Ali, Fadilah Jamaludin and Nur Sabrina Ridzwan</i>	25
THE APPLICATION OF INTUITIONISTIC FUZZY ANALYTIC HIERARCHY PROCESS (IFAHP) IN SOLVING PERSONNEL SELECTION PROBLEM <i>Nor Faradilah Mahad, Che Siti Zaiznena Che Mat Zain, Saffiya Nuralisa Mohd Syahidan and Nur Qamarina Hanim Saidin</i>	29
SOLUTION OF FISHER'S EQUATION USING INTEGRAL ITERATIVE METHOD <i>Mat Salim Selamat, Nursyaqila Zakaria, Siti Aisyah Mahrop, and Raja Iryana Puteri Raja Azman Shah</i>	33
MIXED INTEGER PROGRAMMING APPROACH FOR MINIMIZING TRAIN DELAY <i>Nurul Liyana Abdul Aziz, Nur Faqihah Jalil, Faridatul Azra Md Shamsul and Zaliyah Abbas</i>	36
SOLVING LANE-EMDEN EQUATION USING PADE APPROXIMATION METHOD <i>Najir Tokachil, Muhammad Aiman, Noramira Farzana, and Nurul Shahira Aimie</i>	40

DETERMINANTS OF GRADUATE STARTING SALARY: A CASE STUDY*Nora Mohd Basir, Yong Zulina Zubairi, Rohana Jani and Diana Abdul Wahab***43****KMV MODEL IN PREDICTING SOVEREIGN DEBT DEFAULT***Siti Mahani Isman, Nur Faiqah Mohd Ngasri, Nazihah Misman, and Norliza Muhamad Yusof***46****TEMIMI AND ANSARI METHOD FOR SOLVING QUADRATIC RICCATI DIFFERENTIAL EQUATION***Mat Salim Selamat, Nurul Syafiqah Tajudin, Wahyu Hidayah Roslan and Nur Aqilah Rosli***50****AWARENESS ON PREVENTION OF CORONAVIRUS (Covid-19): A CASE STUDY OF INTERNSHIPS STUDENTS IN UNIVERSITI TEKNOLOGI MARA CAWANGAN NEGERI SEMBILAN***Syafiqah Samat, Nurdia Azlin Ghazali, Nur Hidayah Mohd Razali and Noor Aisyah Idris***52**

NUMERICAL APPROXIMATION OF BLASIUUS EQUATION USING DAFTARDAR-GEJJI AND JAFARI METHOD

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Keywords: Blasius equation; Daftardar-Gejji and Jafari method

1. Introduction

In this study, the Blasius equation is solved by using the Daftardar-Gejji and Jafari method (DJM)(Daftardar-Gejji and Jafari, 2006). The Blasius equation is a third order nonlinear differential equation which comes from boundary layer equations. The obtained series solution is combined with the diagonal Padé approximants to handle the boundary condition at infinity.

The Blasius equation is given by (Wazwaz, 2007):

$$u'''(x) + \frac{1}{2}u(x)u''(x) = 0 \quad (1)$$

with initial and boundary conditions: $u(0) = 0$, $u'(0) = 1$, $u'(\infty) = 0$.

2. Method

Consider the general functional equation (Hemeda and Eladdad, 2018):

$$u(x) = f(x) + N(u(x)) \quad (2)$$

where N is a nonlinear operator from a Banach space $B \rightarrow B$ and f is a known function of the Banach space B . The solution $u(x)$ can be given in the form:

$$u(x) = \sum_{i=0}^{\infty} u_i(x) \quad (3)$$

The nonlinear operator N can be decomposed as:

$$N\left(\sum_{i=0}^{\infty} u_i(x)\right) = N(u_0) + \sum_{i=0}^{\infty} \left\{ N\left(\sum_{j=0}^i u_j(x)\right) - N\left(\sum_{j=0}^{i-1} u_j(x)\right) \right\} \quad (4)$$

Therefore, (2) is equivalent to:

$$\sum_{i=0}^{\infty} u_i(x) = f + N(u_0) + \sum_{i=0}^{\infty} \left\{ N\left(\sum_{j=0}^i u_j(x)\right) - N\left(\sum_{j=0}^{i-1} u_j(x)\right) \right\} \quad (5)$$

Then, the solution can be obtained from recurrence relation:

$$\begin{aligned} u_0 &= f, \\ u_1 &= N(u_0), \\ u_{r+1} &= N(u_0 + u_1 + \dots + u_r) - N(u_0 + u_1 + \dots + u_{r-1}), \quad r = 1, 2, \dots \end{aligned} \quad (6)$$

and

$$u_i = f + N \left(\sum_{i=0}^{\infty} u_i \right). \quad (7)$$

The r -term approximate solution of (2) and (3) is given by $u(x) = \sum_{i=0}^{r-1} u_i$.

3. Results

Applying the DJM to (1) yields:

$$\begin{aligned} u_n(x) = & x + \frac{1}{2}Ax^2 - \frac{1}{48}Ax^4 - \frac{1}{240}A^2x^5 + \frac{1}{960}Ax^6 \\ & \frac{11}{20160}A^2x^7 + \left(-\frac{1}{21504}A + \frac{11}{161280}A^3 \right) x^8 - \frac{43}{967680}A^2x^9 + \dots \end{aligned} \quad (8)$$

Then, by utilizing the Padé approximants and $u'(\infty) = 0$, the values of A are obtained as in Table 1. Comparison with results by using Adomian Decomposition Method (ADM) and Differential Transform Method (DTM) is also shown.

From Table 1, the numerical results for $u''(0) = A$ obtained by using different diagonal Padé approximants and the results are in good agreement with the results in Wazwaz (2007) and Ertürk and Momani (2008). This demonstrates the efficiency and accuracy of the DJM-Padé approximants approach for solving Blasius equation.

Table 1: Comparison result between ADM, DTM and DJM

Padé Approximant	ADM (Wazwaz, 2007)	DTM (Ertürk and Momani, 2008)	DJM
$[2/2]$	0.5773502693	0.5773502692	0.5773502692
$[3/3]$	0.5163977793	0.5163977795	0.5163977795
$[4/4]$	0.5227030796	0.5227030976	0.5227030976

4. Conclusion

DJM was applied to compute approximate solutions for Blasius equation. The computation verify that the DJM is an effective tool for solving nonlinear problem in fluid dynamic. Combination with Padé approximants provides a promising tool to handle problems on an unbounded domain.

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MATHEMATICS
IN APPLIED RESEARCH

VOLUME III

