State University of Makassar

INTERNATIONAL CONFERENCE ON MATHEMATICS, SCIENCES, TECHNOLOGY, EDUCATION AND THEIR APPLICATIONS

"Recent Research and Issues in Mathematics, Sciences, Technology, Education and their Applications"

PROCEEDINGS

ICMSTEA 2014

Makassar, August 20-21, 2014

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Faculty of Mathematics and Science
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ICMSTEA 2014: RECENT RESEARCH AND ISSUES ON MATHEMATICS, SCIENCE, TECHNOLOGY, EDUCATION AND THEIR APPLICATIONS

Preface

All praise to Allah SWT, because His mercy and blessings, the proceedings of the "International Conference on Recent Research and Issues in Mathematics, Sciences, Technology, Education and Their Applications (ICMSTEA) 2014" is now finally in our hands. ICMSTEA 2014 was succesfully held at Phinisi Building, State University of Makassar on 20th – 21st August, 2014 and followed 149 parallel speakers and around, around 450 participants in total that registered and participanted from many universities in Indonesia and abroad. It is assigned to celebrate the 53rd commemoration of State University of Makassar. The conference is organized by the Faculty of Mathematics and Science in conjunction with several committee members from the other faculties within State University of Makassar.

These proceedings are divided into two volumes, the first volume contains all the papers in the field of mathematics education, science education and its applications, and the second volume contains all the papers in the fields of mathematics, science and its applications. We hope that everything contained in these proceedings will expand scientific insights while providing new research ideas and innovations to the conference participants and the reader.

We would like to thanks to the authors for contributing their papers, and the reviewers who have provided assessment and feedback during the editing process. We also would like to thanks to those who have helped the settlement of this proceedings.

We apologize if there are any mistakes in these proceedings. We also would like to express my highest appreciation to the sponsors who have contributed to the successful implementation of ICMSTEA 2014 conference and the publication of these proceedings.

Editor Team

Forewords from the Head of Committee

Assalamu'alaikum Warahmatullahi Wabarakatuh.
Good morning and may God's blessings be upon us all.

Your Excellency the Rector of State University of Makassar (UNM) Prof. Dr. H. Arismunandar, M.Pd. Ladies and gentlemen, on behalf of the conference committee, first, I would like to give our welcome to all the delegates, keynote speakers, invited speakers, parallel speakers and participants coming today. Welcome to the conference, welcome to State University of Makassar, and welcome to Makassar.

This conference entitled "*International Conference on Recent Research and Issues in Mathematics, Sciences, Technology, Education and Their Applications (ICMSTEA) 2014*". It is assigned to celebrate the 53rd commemoration of State University of Makassar. The conference is organized by the Faculty of Mathematics and Science in conjunction with several committee members from other faculties within State University of Makassar.

Ladies and gentlemen, the conference proudly invites eleven keynote speakers coming from several countries. Therefore, I would like to express my sincere thanks to the keynote speakers, including:

1. Professor Max Warshauer (Texas State University, USA)
2. Professor Naoki Sato (Kyoto University, Japan)
3. Professor Peter Hubber (Deakin University, Australia)
4. Professor Susie Groves (Deakin University, Australia)
5. Dr. Frans van Galen (Utrecht University, Netherlands)
6. Professor Duangjai Nacapricha (Mahidol University, Thailand)
7. Professor Baharuddin bin Aris (Universiti Teknologi Malaysia, Malaysia)
8. Professor Suratman Woro Suprodjo (Gadjah Mada University, Indonesia)
9. Professor Ismail bin Kailani (UniversitiTeknologi Malaysia, Malaysia)
10. Professor Muhammad Arif Tiro (State University of Makassar)
11. Dr. Siti Nuramaliati Prijono (The Indonesian Institute of Sciences)

I would like also to give sincere thanks and gratitude to the invited speakers, including:

1. Prof. Dr. H. Arismunandar, M.Pd. (State University of Makassar)
2. Prof. Kristian H. Sugiyarto, Ph.D. (State University of Yogyakarta)
3. Prof. Dr. Sutarto Hadi (Lambung Mangkurat University)
4. Dr. Nurdin Noni, M.Hum. (State University of Makassar)
5. Dr. Yuni Sri Rahayu, M.Si. (State University of Surabaya)
6. Dr. Ayuddin M.T. (State University of Gorontalo)
7. Dr. Usman Pagalay (State Islamic University of Malang)
8. Dr. Suyanta, M.Si. (State University of Yogyakarta)
9. Dr. Elisa Sesa, M.Sc. (Tadulako University, Palu)

Next, I want to thanks and welcome to 149 parallel speakers and totally, 450 participants approximately are registered to participate from many universities in Indonesia from Aceh to Papua, and other countries. All of them have shared their research and theoretical papers presented and discussed in the conference.

In this occasion, I would like to thanks to Deputy of Governor of South Sulawesi Province (Ir. H. Agus Arifin Nu'mang, M.Si), Mayor of Makassar City (Ir. H. Ramdhan Dhany Pomanto), Rector of UNM (Prof. Dr. H. Arismunandar, M.Pd.), and Director of Post Graduate Program of UNM (Prof. H. Jasruddin Daud Malago), who are very kind to be the host of welcoming dinner and lunch during the conference.

I want to thanks also to Kalla Group, KIA Kalla, Erlangga Press, Opti Lab, and e-Bimbel Yogyakarta for their contribution as the sponsors of this conference.

Finally, it is my privilege to thanks to all organizing committee members who have been showing good work and determination for the accomplishment of this conference. I would like to apologize to all of you when there are some inconvenience things during the implementation of this conference.

Thank you and wish you have a meaningful conference.

Assalamu'alaikum Warahmatullahi Wabarakatuh.

Head of Committee,

Suwardi Annas, Ph.D.

Forewords from the Dean of Faculty of Mathematics and Science, State University of Makassar

Bismillahirrahmanirrahim
Assalamu'alaikum Warahmatullahi Wabarakatuh

First of all, let us praise to the Almighty, Allah SWT, because of his Blessings and Helps, we are able to gather here to attend the International Conference on Recent Research and Issues in Mathematics, Sciences, Technology, Education and Their Applications (ICMSTEA) 2014.

The development of education and technology in recent decades grows very rapidly. In addition, they have been specialized into many specific topics. Indeed, for researchers and lecturers, being qualified of a specific field as well as being aware of the contemporary development of other fields are two crucial things. One of the reasons why we undertake the conference is to fulfill those two things. By attending the conference, researchers and lecturers have a good opportunity to share their research findings and to obtain broader descriptions of the development of other general knowledge.

We convey our deep appreciation and gratitude to all of the committees that work from the beginning to support and organize the conference. We also strongly expect the participants of the conference to be continually productive, increase the capacity in conducting a research, and carry out both national and international scientific publications.

Finally, let me again recite thank you to the all participants of the conference who are receptive to spend their time to be present and entirely involved at this events. I wish the conference advantageous for all of us.
Billahitaufiqwalhidayah,

Wassalamu'alaikum Warahmatullahi Wabarakatuh.

Dean of Faculty of Mathematics and Science
State University of Makassar

Prof. Dr. H. Hamzah Upu, M.Ed.

Forewords from Rector of UNM

Bismillahirrahmanirrahim
Assalamu’alaikum Warahmatullahi Wabarakatuh

Your respectable, the high officials of State University of Makassar, the committee, the speakers, and the participants of conference.

It gives me a great pleasure to extend to you all a very warm welcome, especially to our keynote speakers who have accepted our invitation to attend the conference.
It is an opportune time to convey to you that UNM is celebrating the 53rd Dies Natalis and it commends the faculty of Mathematics and Science (FMIPA) to be in charge of all activity sequences in the Dies Natalis. However, the support of other faculties is also really influential and gives valuable contribution to the success of the event.

In that celebration, we undertake several agendas including educational and sport activities. The conference, ICMSTEA, is one of our educational activities that covers a wide range of very interesting items relating to mathematics, sciences, education, technology and their applications.

By taking participation of this seminar, it is highly expected to all of us to share our research findings to society and continuously develop new ideas and knowledge. Those things are two significant steps in improving the quality of nations around the world, increasing our familiarity to each other, and even avoiding underdevelopment.

On this good occasion, let me quote what Obama said about the education related to this conference and I wish fruitful for all of us:

Every single one of you has something you’re good at. Every single one of you has something to offer. And you have a responsibility to yourself to discover what that is. That is the opportunity an education can provide.

Furthermore, I would like to take this opportunity to express my heartfelt gratitude to all organizing committee especially for the Faculty of Mathematics and Science that primarily hosts this conference particularly and other Dies Natalis events generally.

Finally, this is a great time for me to declare the official opening of the International Conference on Recent Research and Issues in Mathematics, Sciences, Technology, Education and Their Applications (ICMSTEA) 2014.

I wish you a very enjoyable stay in Makassar, I warmly welcome you again, as in Makassar, we say “salamakki battu ri mangkasara”.

Wassalamu’alaikumwarahmatullahiwabarakatuh.

Rector of State University of Makassar

Prof. Dr. H. Arismunandar, M.Pd.

TABLE OF CONTENTS

APPROXIMATE ANALYTICAL SOLUTION FOR SIR MODEL OF DENGUE DISEASE IN SOUTH SULAWESI USING HOMOTOPY ANALYSIS AND ITERATION VARIATION METHOD

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Abstract

Model Susceptible-Infected-Recovered (SIR) of the dengue disease are considered in this article. Analytical methods for the numerical iteration method namely variations (MIV) and the homotopy analysis method (MAH) is applied to solve the SIR model of dengue disease. Lagrange coefficients sought then used in MIV and additional parameters in homotopy theory in MAH. Schema of these methods is very easy to use and also produces a convergent series so that near to actual solution when compared to traditional methods. The results obtained, MIV more accurate representation of MAH for a time interval $t \leq 9$ when compared with actual data and RK4 method. MIV can be an alternative method for the answers SIR model or other nonlinear systems.

Keywords: Variation iteration method, homotopy perturbation method, SIR Model, Lagrange coefficients.

1. Introduction

Variation iteration method (MIV) was introduced by He, 1997. Legendre multiplication algorithm sought to carry MIV. He has completed a variety of differential equations using MIV (He, 1998,2007). His research has shown that HIV is a powerful method to obtain approximate solutions. Yildirim and Cherruault, 2009 have solved the SIR model with constant vaccanasi strategy. Abu Bakar et al, 2013 obtain an approximate solution of the SIR model infected with the disease using HPM. Gothbi et al, 2011 obtain an approximate solution of the general SIR model using MIV and HPM.

Haemorrhagic fever is a disease caused by a virus of the Togaviridae genus, subgenus Flavivirus. The virus in question is transmitted into the human body throu the bite of mosquitoes that act as vecto In Southeast Asia in general and Indones in particular the mosquito Aedes aegypti a major vector of dengue viruses that cau outbreaks. There is no specific vaccine f the treatment of dengue fever, Mo Rizam et all, 2008.

Interesting phenomenon in t spread of dengue in this period is t displacement of the age of the patie Dengue fever is common earlier in childr of primary school age, but now there is lot of attacking humans in all ag Syafruddin and Noorani 2013. T mortality rate of this virus could reach percent of patients, then this is a dangero threat to about 2.5 billion people in t entire world, especially people in t tropical and subtropical countries.

Mathematical modeling and nonlinear dynamic method used in comparing, designing, implementing and optimizing assess various identification, prevention, treatment, control and program. Therefore, the mathematical model can be a useful tool to better understand the mechanisms that justify the outbreak of dengue fever and control strategies to improve the speed of the mosquito (vector).

In this paper, a model Susceptible-Infected-Removed (SIR) to be considered, which is expected to be able to know the number of hosts infected with the epidemic, the number of hosts recovered, the number of mosquitoes that cause dengue fever was suspected. This model has been modified by Side and Noorani, 2013 becomes:

$$\frac{dx}{dt} = \mu_h\left(1 - x(t)\right) - \alpha x(t)z(t) \quad (1)$$

$$\frac{dy}{dt} = \alpha x(t)z(t) - \beta y(t) \quad (2)$$

$$\frac{dz}{dt} = \gamma\left(1 - z(t)\right)y(t) - \delta z(t) \quad (3)$$

where μ_h is human life span, the shape of the number suspectable rate $A, b\beta_h$ is the number of the host population, μ_v is the life span of mosquitoes, N_h is the number of the host population, $\alpha = \frac{b\beta_h A}{\mu_v N_h}$, $\beta = \gamma_h + \mu_h$, $\gamma = b\beta_v$ and $\delta = \mu_v$ inhomogeneous form.

2. Variation Iteration Method (MIV)

Variation iteration method (MIV) was introduced by He in 1997. MIV developed from common Lagrange coefficients method with iteratively run. The virtue of this method is assuming completion linearization mathematically used as an initial approximation, the approximation is appropriate for some particular point can be obtained.

To understand the basic concepts MIV, first consider the different equation form as follows:

$$Lu + Nu = g(t), \quad ($$

where L is a linear operator, the operat N is not linear and $g(t)$ is n homogeneous term. According MIV, cou in the form of a justification function follows:

$$u_{i,n+1} = u_{i,n} + \int_0^t \lambda(s)\left[Lu_{i,n} + N\tilde{u}_{i,n} - g(t)\right]ds,$$

Where $i = 1, 2, \ldots, m$, λ is Lagran coefficient (Inokuti, 1978), which can identified using the theory of variation, denoted as an approximation to-n and $\tilde{u}$ be considered as a discontinuous variati (Inokuti, 1978), as $\delta\tilde{u}_{i,n} = 0.$ The iterati scheme in equation (5) will be close to th exact completion for $n \to \infty$ as follow:

$$u_i(t) = \lim_{n \to \infty} u_{i,n}(t) \quad (6$$

3. Homotopi Analysis Method (MAH)

Consider the following different equation:

$$N_i[z_i(t)] = 0, \quad i = 1,2,\cdots,n, \quad (7$$

Where N_i is linear operator which show the entire equality, x and t are independe variables and $z_i(t)$ is an unknov function. With the traditional general sen Homotopi method, Liao, 1992 to build t so-called zero-order deformation equatio

$$(1-q)L\left[\phi_i(t;q) - z_{i,0}(t)\right] = q\hbar_i N_i[\phi_i(t;q)], \quad ($$

Where $q \in [0,1]$ is a embedded paramet $\hbar_i$ is an additional parameter, L is a line operator addition, $z_{i,0}(t)$is the initial gue of $z_i(t)$ and $\phi_i(t;q)$ is a unknov function. It is important to note that person's bias freely choose additio objects such as $\hbar_i$ and L in MAH. Clear if both $q = 0$ and $q = 1$ then

$$\phi_i(t;0) = z_{i,0}(t) \text{ and } \phi_i(t;1) = z_i(t), \quad (9$$

Satisfied. So q ascending from 0 to 1, the completion of various $\phi_i(t;q)$ of the initial assessment $z_{i,0}$ to completion $z_i(t)$. Expantion $\phi_i(t;q)$ by a Taylor series against q, obtained :

$$\phi_i(t;q) = z_{i,0}(t) + \sum_{m=1}^{+\infty} z_{i,m}(t)q^m, \quad (10)$$

where

$$z_{i,m} = \frac{1}{m!}\frac{\partial^m \phi_i(t;q)}{\partial q^m}\bigg|_{q=0}. \quad (11)$$

If additional linear operator, the initial guess of additional parameters $\hbar_i$,, and additional function is selected, then the equation of the series (10) converges to q = 1 and

$$\phi_i(t;1) = z_{i,0}(t) + \sum_{m=1}^{+\infty} z_{i,m}(t), \quad (12)$$

This became the settlement of non linear equations of origin, as proved by Liao. As with $\hbar = -1$, equation (8) becomes:

$$(1-q)L[\phi_i(t;q) - z_{i,0}(t)] + qN_i[\phi_i(t;q) - z_{i,0}(t)] = 0, \quad (13)$$

Which method mostly used in the HPM. (He, 1999).

From (13), the construction of the equation can be deduced from the zero-order deformation equation. Defined vector

$$\bar{z}_{i,n} = [z_{i,0}(t), z_{i,1}(t), \cdots, z_{i,n}(t)] \quad (14)$$

Differentiation (25) m times as much on the setting of parameters q and then let q = 0 and finally divided them by m!, We call to-order deformation equation m.

$$L[z_{i,m}(t) - \chi_m z_{i,m}(t)] = \hbar_i R_{i,m}(\bar{z}_{i,m-1}), \quad (15)$$

where

$$R_{i,m}(\bar{z}_{i,m-1}) = \frac{1}{(m-1)!}\frac{\partial^{m-1}\phi_i(t;q)}{\partial q^{m-1}}\bigg|_{q=0}, \quad (16)$$

and

$$\chi_m = \begin{cases} 0, & m \le 1, \\ 1, & m > 1. \end{cases} \quad (1$$

It is emphasized that $z_{i,m}(t)\, m \ge$ constructed by the linear equation (1 with linear boundary conditions that co from original problem, which can be easi solved with a computer symbol cr MAPLE or MATHEMATICA.

3.1. MIV application for Sir Mode from Spread of Dengue Fever Disea

Variation iteration method is a method semi analytic powerful and widely used solve differential equations. The ba theory for using MIV, first, rewritten S model of dengue fever as follows:

$$\frac{dx}{dt} = \mu_h(1 - x(t)) - \alpha x(t)z(t)$$

$$\frac{dy}{dt} = \alpha x(t)z(t) - \beta y(t)$$

$$\frac{dz}{dt} = \gamma(1 - z(t))y(t) - \delta z(t)$$

where μ_h is human life span, the shape the number susceptible rate $A, b\beta_h$ is t number of the host population, μ_v is t life span of mosquitoes, N_h is the numb of the host population, $\alpha = \frac{b\beta_h A}{\mu_v N_h}$, β $\gamma_h + \mu_h$, $\gamma = b\beta_v$ and $\delta =$ inhomogeneous form

To use the SIR model MIV, built functio justification as follows:

$$x_{n+1}(t) = x_n + \int_0^t \lambda_1(s)\left[\frac{dx_n}{ds} - \mu_h(1 - x_n) + \alpha\widetilde{x_n z_n}\right] ds, \quad (1$$

$$y_{n+1}(t) = y_n + \int_0^t \lambda_2(s)\left[\frac{dy_n}{ds} - \alpha\widetilde{x_n z_n} + \beta y_n\right] ds, \quad (1$$

$$z_{n+1}(t) = z_n + \int_0^t \lambda_3(s)\left[\frac{dz_n}{ds} - \gamma y_n + \gamma\widetilde{y_n z_n} + \delta_1 z_n\right] ds, \quad (20)$$

Where $\lambda_i,\ i = 1,2,3$ is a general Lagrange coefficient which can be identified optimally by theory of variation and the subscript n denotes to-n. To obtain $\lambda(s)$ is optimal, do the following:

$$\delta x_{n+1} = \delta x_n + \int_0^t \delta\lambda_1(s)\left[\frac{dx_n}{ds} - \mu_h(1 - x_n) + \alpha\widetilde{x_n z_n}\right] ds, \quad (21)$$

$$\delta y_{n+1} = y_n + \int_0^t \delta\lambda_2(s)\left[\frac{dy_n}{ds} - \alpha c\beta\widetilde{y_n}\right]\ ds, \quad (22)$$

$$z_{n+1} = z_n + \int_0^t \lambda_3(s)\left[\frac{dz_n}{ds} - \gamma\widetilde{y_n} + \gamma\widetilde{y_n z_n} + \delta_1\widetilde{z_n}\right]\ ds, \quad (23)$$

where $\tilde{x}_n, \tilde{y}_n,\ \widetilde{y_n z_n}, \widetilde{x_n z_n},$ and $\tilde{z}_n$ considered as a discontinuous variation i,$\tilde{x}_n, \tilde{y}_n = 0$ and $\tilde{z}_n = 0$. Then, we have

$$\delta x_{n+1} = \delta x_n + \int_0^t \delta\lambda_1(s)\left[\frac{dx_n}{ds} + \mu_h x_n\right] ds, \quad (24)$$

$$\delta y_{n+1} = y_n + \int_0^t \delta\lambda_2(s)\left[\frac{dy_n}{ds} + \beta y_n\right]\ ds, \quad (25)$$

$$\delta z_{n+1} = \delta z_n + \int_0^t \delta\lambda_3(s)\left[\frac{dz_n}{ds} + \delta_1 z_n\right]\ ds, \quad (26)$$

or

$$\delta x_{n+1} = \delta x_n + \int_0^t \left[\delta\lambda_1 \frac{dx_n}{ds} + \delta\lambda_1\mu_h x_n\right] ds \quad (27)$$

$$\delta y_{n+1} = \delta y_n + \int_0^t \left[\delta\lambda_2(s)\frac{dy_n}{ds} + \delta\lambda_2\beta y_n\right]\ ds \quad (2$$

$$\delta z_{n+1} = \delta z_n + \int_0^t \left[\delta\lambda_3 \frac{dz_n}{ds} + \delta\delta_1\lambda_3 z_n\right]\ ds \quad (2$$

then

$$\delta x_{n+1} = \delta(1 + \lambda_1)x_n + \int_0^t \delta[\lambda'_1 + \lambda_1\mu_h]x_n\, ds, \quad (3$$

$$\delta y_{n+1} = \delta(1 + \lambda_2)y_n + \int_0^t \delta[\lambda'_2 + \lambda_2\beta]y_n\ ds, \quad (3$$

$$\delta z_{n+1} = \delta(1 + \lambda_3)z_n + \int_0^t \delta[\lambda'_3 + \delta\delta_1\lambda_3]z_n\, ds, \quad (3$$

Thus, the following stationary condition obtained:

$$\delta x_n \quad : \quad (1 - \lambda_1(t))|_{s=t} = 0,$$
$$\delta y_n \quad : \quad (1 - \lambda_2(t))|_{s=t} = 0,$$
$$\delta z_n \quad : \quad (1 - \lambda_3(t))|_{s=t} = 0,$$
$$\delta x_n' \quad : \quad \lambda_1'(s) + \mu_h\lambda_1(s)\big|_{s=t} = 0,$$
$$\delta y_n' \quad : \quad \lambda_2(s) + \beta\lambda_2(s)|_{s=t} = 0,$$
$$\delta z_n' \quad : \quad \lambda_3(s) + \delta_1\lambda_3(s)|_{s=t} = 0,$$

Solution of the system of equatio obtained:

$$\lambda_1(s) = -e^{\mu_h(s-t)},$$
$$\lambda_2(s) = -e^{\beta(s-t)}, \quad (3$$
$$\lambda_3(s) = -e^{\delta_1(s-t)},$$

Here, the general Lagrange coefficients (33) is described by the Taylor series a selected for only one term in t calculation easier, general Lagran coefficients can be written as follows:

$$\lambda_1(s) = -1,$$
$$\lambda_2(s) = -1, \quad (3$$
$$\lambda_3(s) = -1,$$

Substitution of the general Lagrange multipliers in (34) to equation (18)-(20) yields the following iteration formula:

$$x_{n+1}(t) = x_n - \int_0^t \left[\frac{dx_n}{ds} - \mu_h(1 - x_n) + \alpha x_n z_n\right] ds, \quad (35)$$

$$y_{n+1}(t) = y_n - \int_0^t \left[\frac{dy_n}{ds} - \alpha x_n z_n + \beta y_n\right] ds, \quad (36)$$

$$z_{n+1}(t) = z_n - \int_0^t \left[\frac{dz_n}{ds} - \gamma y_n + \gamma y_n z_n + \delta_1 z_n\right] ds. \quad (37)$$

Iteration begins with the initial approximation as obtained from the data of the Indonesian health minister (2007), $c_1 = \frac{7675406}{7675893}, c_2 = \frac{487}{7675893}, c_3 = 0.056$, $\alpha = 0.232198, \beta = 0.328879, \gamma = 0.375$, and $\delta_1 = 0.0323$. The iteration formulas (87) - (89) are obtained:

$$x_1 = 0.9999365546 - 0.0130022687\ t, \quad (38)$$

$$y_1 = 0.00006344538675 + 0.01298140513\ t \quad (39)$$

$$z_1 = 0.056 - 0.001786340333\, t, \quad (40)$$

$$x_2 = 0.9999365546 - 0.0130022687\ t + 2.922132174\ \times 10^{-4}t^2 - 1.797714851\ \times 10^{-6}t^3, \quad (41)$$

$$y_2 = 0.00006344538675 + 0.01298140513\ t + 0.1797714851 \times 10^{-5}t^3 - 0.002426569924\ t^2, \quad (42)$$

$$z_2 = 0.056 - 0.001786340333\, t + 0.002326579355\, t^2 + 0.2898650945\ \times 10^{-5}t^3, \quad (43)$$

$$x_3 = 0.9999365546 - 0.01300226807t - 0.0001831331308t^3 + 0.0002922132174t^2 + 0.1728532016 \times 10^{-12}t^7 + 0.1290829001 \times 10^{-9}t^6 - 0.2997118573 \times 10^{-7}t^5 + 0.1623956764 \times 10^{-5}t^4, \quad (4$$

$$y_3 = 0.00006344538675 + 0.01298140513\ t + 0.000449144614\ t^3 - 0.00242656993\ t^2 - 0.1728532016 \times 10^{-12}t^7 - 0.1290829001 \times 10^{-9}t^6 + 0.2997118573 \times 10^{-7}t^5 - 0.1771743755 \times 10^{-5}t^4, \quad (4$$

$$z_3 = 0.056 - 0.00178634033\ t - 0.000308504557\, t^3 + 0.002326579355\ t^2 - 0.2791579206\ \times 10^{-12}t^7 + 0.1782033109\ \times 10^{-9}t^6 + 0.4208392710\ \times 10^{-6}t^3 - 0.3102165044\ \times 10^{-5}t^4, \quad (4$$

and so on.

3.2. MAH Applications for SIR Moc of the Spread of Dengue Fev Disease

In this section, we use the MAH to resol the SIR model of dengue disease. To sol the SIR model, we defined not line operator as:

$$N[\phi(t;p)] = \alpha x(t)z(t) \quad (4$$

$$N[\phi(t;p)] = \alpha x(t)z(t) \quad (4$$

$$N[\phi(t;p)] = \gamma x(t)y(t) \quad (4$$

and linier operator as:

$$L[\phi(t;p)] = \frac{dx(t)}{dt} + \mu_h x(t) \quad (5$$

$$L[\phi(t;p)] = \frac{dy(t)}{dt} + \beta y(t) \quad (5$$

$$L[\phi(t;p)] = \frac{dz(t)}{dt} + \delta z(t) \quad (5$$

With nature $L[c_1] = 0$ (5

Where c_1 is a constant Integration. Use the above definition, we built zero-order deformation equation:.

$$(1-p)L[\phi(t;p)-x_0(t)] = pN\hbar\phi(t;p)$$
$$(1-p)L[\phi(t;p)-y_0(t)] = pN\hbar\phi(t;p)$$
$$(1-p)L[\phi(t;p)-z_0(t)] = pN\hbar\phi(t;p)$$

Obviously, when $p = 0$ and $p = 1$

$$\phi(t;0) = x_0(t) \text{ and } \phi(t;1) = x(t) \quad (57)$$
$$\phi(t;0) = y(t) \text{ and } \phi(t;1) = y(t) \quad (58)$$
$$\phi(t;0) = z_0(t) \text{ and } \phi(t;1) = z(t) \quad (59)$$

Therefore, the parameter p is embedded p up from 0 to 1, $\phi(t;p)$ of the initial guess $x_0(t)$,, $y_0(t)$ and $z_0(t)$ to the solution $x(t)$, $y(t)$ dan $z(t)$. Then we generate the equations of deformation order to m

$$L[x_m(t) - \chi_m x_{m-1}(t)] = \hbar R_m[\vec{x}_{m-1}(t)], \quad (60)$$
$$L[y_m(t) - \chi_m y_{m-1}(t)] = \hbar R_m[\vec{y}_{m-1}(t)], \quad (61)$$
$$L[z_m(t) - \chi_m z_{m-1}(t)] = \hbar R_m[\vec{z}_{m-1}(t)], \quad (62)$$

With nature

$$x_m(0) = 0, y_m(0) = 0 \text{ dan } z_m(0) = 0, \quad (63)$$

where

$$R_m\vec{x}_{m-1} = \frac{dx_{m-1}}{dt} - \mu_h(1 - x_{m-1}) + \alpha x_{m-1}z_{m-1} \quad (64)$$
$$R_m\vec{y}_{m-1} = \frac{dy_{m-1}}{dt} - \alpha x_{m-1}z_{m-1} + \beta y_{m-1} \quad (65)$$
$$R_m\vec{z}_{m-1} = \frac{dz_{m-1}}{dt} - \gamma(1 - z_{m-1})y_{m-1} + \delta z_{m-1} \quad (66)$$

Now, the solution to-m order deformation equation (60)-(62) for m ≥ 1 be

$$x_m(t) = \chi_m x_{m-1}(t) + \hbar L^{-1}[R_m(\vec{x}_{m-1})] \quad (67)$$
$$y_m(t) = \chi_m y_{m-1}(t) + \hbar L^{-1}[R_m(\vec{y}_{m-1})] \quad (68)$$
$$z_m(t) = \chi_m z_{m-1}(t) + \hbar L^{-1}[R_m(\vec{z}_{m-1})] \quad (69)$$

From (188)-(189), we obtained

$$x_1(t) = \mathbf{0.0130023ht} \quad (54)$$
$$y_1(t) = -\mathbf{0.0129814ht} \quad (55)$$
$$z_1(t) = \mathbf{0.00178634ht} \quad (56)$$
$$x_2(t) = \mathbf{h}\,(\mathbf{0.0130023} + \mathbf{h}\,(\mathbf{0.0130023} + \mathbf{0.000292213t}))\,\mathbf{t}$$
$$y_2(t) = \mathbf{h}\,(-\mathbf{0.0129814} + \mathbf{h}\,(-\mathbf{0.0129814} - \mathbf{0.00242657t}))\,\mathbf{t}$$
$$z_2(t) = \mathbf{h}\,(\mathbf{0.00178634} + \mathbf{h}\,(\mathbf{0.00178634} + \mathbf{0.00232658t}))\,\mathbf{t}$$
$$\vdots$$
$$\begin{aligned} x_9(t) &= \mathbf{ht}\,(0.00650106 + h\,(0.0520084 + 0.000989346t) - 0.00243469h2\,(-10.1851 + t)\,(7.34063 + t) \\ &- 0.000428958h3\,(-5.29982 + t)\,(4.60885 + t)\,(34.7459 + t) - 4.2441 \times 10 \\ &- 6h5\,(-2.71198 + t)\,(2.6422 + t)\,(41.961 + t)\,(285.291 + 17.5578t + t2) \\ &- 0.0000630769h4\,(-3.58688 + t)\,(3.35883 + t)\,(598.835 + 34.2308t + t2) - 3.63559 \\ &\times 10 - 9h7\,(-1.82348 + t)\,(1.85195 + t)\,(45.9417 + t)\,(108.68 + 7.81085t + t2)\,(848.425 + 40.684t + t2) \\ &- 1.71718 \times 10 - 7h6\,(-2.18059 + t)\,(2.1776 + t)\,(165.886 + 11.051t + t2)\,(1345.75 + 63.0985t + t2) \\ &- 3.42828 \times 10 - 11h8\,(-1.56695 + t)\,(1.61103 + t)\,(76.8168 + 5.92602t + t2)\,(582.289 + 29.3336t + t2)\,(1679.4 + 70.7431t + t2)) \end{aligned}$$

$$
\begin{aligned}
&y_9(t)\\
&= \mathbf{ht}\,(\mathbf{0.00648019}\\
&+ \mathbf{h}\,(\mathbf{0.0518415} + \mathbf{0.00753665t})\\
&+ \mathbf{h2}\,(\mathbf{0.181445} + \mathbf{0.0527565t}\\
&+ \mathbf{0.00532649t2})\\
&+ \mathbf{0.00130479h3}\,(\mathbf{18.8384}\\
&+ \mathbf{t})\,(\mathbf{14.7636} + \mathbf{5.65524t} + \mathbf{t2})\\
&+ \mathbf{0.0000117427h5}\,(\mathbf{30.714}\\
&+ \mathbf{t})\,(\mathbf{5.1273} + \mathbf{2.92311t}\\
&+ \mathbf{t2})\,(\mathbf{196.238} + \mathbf{24.3779t} + \mathbf{t2})\\
&+ \mathbf{0.000170313h4}\,(\mathbf{8.12912}\\
&+ \mathbf{3.87288t} + \mathbf{t2})\,(\mathbf{327.639}\\
&+ \mathbf{34.4327t} + \mathbf{t2}) + \mathbf{8.91809} \times \mathbf{10}\\
&- \mathbf{9h7}\,(\mathbf{37.9455} + \mathbf{t})\,(\mathbf{2.56996}\\
&+ \mathbf{1.9474t} + \mathbf{t2})\,(\mathbf{85.4541}\\
&+ \mathbf{14.2503t} + \mathbf{t2})\,(\mathbf{697.568}\\
&+ \mathbf{46.5838t} + \mathbf{t2}) + \mathbf{4.49146} \times \mathbf{10}\\
&- \mathbf{7h6}\,(\mathbf{3.52435} + \mathbf{2.33985t}\\
&+ \mathbf{t2})\,(\mathbf{124.977} + \mathbf{18.1441t}\\
&+ \mathbf{t2})\,(\mathbf{917.17} + \mathbf{57.9493t} + \mathbf{t2})\\
&+ \mathbf{7.48431} \times \mathbf{10} - \mathbf{11h8}\,(\mathbf{1.95642}\\
&+ \mathbf{1.66613t} + \mathbf{t2})\,(\mathbf{61.8578}\\
&+ \mathbf{11.6651t} + \mathbf{t2})\,(\mathbf{480.128}\\
&+ \mathbf{36.6988t} + \mathbf{t2})\,(\mathbf{1490.13}\\
&+ \mathbf{69.1273t} + \mathbf{t2}))
\end{aligned}
\tag{77}
$$

$$
\begin{aligned}
&z_9(t)\\
&= \mathbf{ht}\,(\mathbf{0.00176388}\\
&+ \mathbf{h}\,(\mathbf{0.014111} - \mathbf{0.0181237t})\\
&- \mathbf{0.00685209h2}\,(-\mathbf{0.38144}\\
&+ \mathbf{t})\,(\mathbf{18.8963} + \mathbf{t})\\
&- \mathbf{0.000266679h4}\,(-\mathbf{0.188767}\\
&+ \mathbf{t})\,(\mathbf{27.2036} + \mathbf{t})\,(\mathbf{90.1624}\\
&+ \mathbf{11.1193t} + \mathbf{t2})\\
&- \mathbf{0.00203391h3}\,(-\mathbf{0.252556}\\
&+ \mathbf{t})\,(\mathbf{192.295} + \mathbf{20.4661t} + \mathbf{t2})\\
&- \mathbf{9.99596} \times \mathbf{10}\\
&- \mathbf{7h6}\,(-\mathbf{0.125412}\\
&+ \mathbf{t})\,(\mathbf{29.0349} + \mathbf{t})\,(\mathbf{33.2557}\\
&+ \mathbf{5.35292t} + \mathbf{t2})\,(\mathbf{408.016}\\
&+ \mathbf{29.4299t} + \mathbf{t2}) - \mathbf{3.3596} \times \mathbf{10}\\
&- \mathbf{10h8}\,(-\mathbf{0.0938972}\\
&+ \mathbf{t})\,(\mathbf{30.7177} + \mathbf{t})\,(\mathbf{17.1227}\\
&+ \mathbf{3.41863t} + \mathbf{t2})\,(\mathbf{233.497}\\
&+ \mathbf{18.0832t} + \mathbf{t2})\,(\mathbf{455.288}\\
&+ \mathbf{29.7748t} + \mathbf{t2})\\
&- \mathbf{0.0000212222h5}\,(-\mathbf{0.150702}\\
&+ \mathbf{t})\,(\mathbf{51.5343} + \mathbf{7.31133t}\\
&+ \mathbf{t2})\,(\mathbf{599.309} + \mathbf{43.1035t}\\
&+ \mathbf{t2}) - \mathbf{2.75153} \times \mathbf{10}\\
&- \mathbf{8h7}\,(-\mathbf{0.10739} + \mathbf{t})\,(\mathbf{23.2175}\\
&+ \mathbf{4.18525t} + \mathbf{t2})\,(\mathbf{295.97}\\
&+ \mathbf{21.8287t} + \mathbf{t2})\,(\mathbf{694.954}\\
&+ \mathbf{46.7509t} + \mathbf{t2}))
\end{aligned}
\quad (7
$$

In the end, we use nine terms to get t following approximation solution:

$$x_{app}(t) = \sum_{i=9}^{9} x_i \quad (79$$

$$x_{app}(t) = \sum_{i=9}^{9} y_i \quad (80$$

$$x_{app}(t) = \sum_{i=9}^{9} z_i \quad (8$$

4. Result and Discussion

From the data obtained by the researcher (KKM, 2007-2008), rate of infection for humans to be cured is (γ_h)=0.3288330, the effective contact rate, humans to mosquitoes is ($b\beta_v$)=0.3750000, the effective contact rate, humans to mosquitoes is ($b\beta_h$)=0.7500000, human life span (μ_h)=0.0000460, the life span of mosquitoes (μ_v)=0.0323000. Iteration and the term has been preceded by $x(0)=\frac{7675406}{7675893}$, $y(0)=\frac{487}{7675893}$, and $z(0)=0.056$. Iteration of the SIR model superbly encoded using MAPLE and MATHEMATICA package USING dig 16. MIV iterations to 10, MAH term to 1 RK4 at $\Delta t = 0.001$ is used to get settlement from SIR models of deng fever then shown a comparison betwe the results of the MAH, MIV and real da in Table 1. From table 1 it can be se MIV more accurate than the MAH. MA will be divergent for the interval $t \geq$ whereas MIV intervals will be diverge $t \geq 9$.

Table 1. Absolute error of MAH solutions and MV compared to RK4 with h = 0:001 and $\hbar$ = -1

t	MIV			MAH		
	Δx	Δx	Δz	Δx	Δy	Δz
1	2.401 E-11	3.934E-10	2.852E-10	1.759 E-08	3.553e-09	3.624e-08
2	7.439 E-11	7.198E-11	6.156E-12	2.136 E-06	7.740e-07	4.457e-06
3	1.514 E-08	4.335E-08	3.289E-08	3.456 E-05	1.869e-05	7.341e-05
4	3.386E-07	9.813E-07	7.455E-07	2.463 E-04	1.759 E-04	5.376 E-04
5	3.704 E-06	1.082E-05	8.220E-06	1.124 E-03	9.864 E-04	2.548 E-03
6	2.579 E-05	7.602E-05	5.772E-05	3.877 E-03	1.149 E-03	2.928 E-03
7	1.313 E-04	3.912 E-04	2.968 E-04	1.105 E-02	3.986 E-03	2.799 E-02
8	5.306 E-04	1.602 E-03	1.215 E-03	2.746 E-02	3.501 E-02	7.467 E-02
9	1.791 E-03	5.506 E-03	4.188 E-04	6.156 E-02	8.397 E-02	0.1811
10	5.218 E-03	1.645 E-02	1.263 E-02	0.1274	0.1819	0.4076
11	1.335 E-02	4.379 E-02	3.44 E-02	0.2476	0.3625	0.8636
12	3.008 E-02	0.1055	8.677 E-02	0.4574	0.6736	1.739

5. Conclusion

1. The number of infected humans will reach the peak in the 12th and then will decline until eventually no man no infected humans (this happens if we anticipate the symptoms of dengue fever as early as possible).
2. The more people who suspect the less infected and vice versa.
3. The number of infected mosquitoes is directly proportional to the number of infected humans.
4. The use of semi- numerical analytic method has been a concern for researchers. Variation iteration method (MIV) and the method of analysis Homotopi (MAH).

5. The results of the use of semi-numerical method is analytical , accurate MIV for the time interval t ≤ 9, MAH is accurate for the time interval t ≤ 7. In addition, the calculation of the scheme, MIV easier in the calculation compared with MAH. From the results obtained MIV could be an alternative method to penyelesian SIR model or other nonlinear systems .

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