MATHEMATICAL ERROR: A METAPHOR FOR SIN

by

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INTRODUCTION

It was at one of the camp-meetings in the early 70s when a group came out to promote the then Adventist College Of West Africa, which is now the Adventist Seminary of West Africa, as an effort for student recruitment into the school. In the course of the promotion, a lecturer among them, by name D.T Agboola, stood up and said,

> ".... we have the best to offer you, we will give you a good Christian education. We offer courses leading to degrees in ...., christian biology, christian chemistry, English, ...".

The degree in christian biology caught my attention - what could this mean? Will they be teaching biology from the bible alone? Does it mean that they can have a B.Sc. degree in christian mathematics too? These questions and many more came to my mind. Since my graduation from a secular University, I have always been thinking on how God can be presented in Mathematics by a teacher with the aim of developing more than the mental aspect but spiritual and physical also.

In the doing of Mathematics,
- there is a search for true patterns and true relationships;
- there is a need to be a able to rightly use it's power, precision and concise means of communications to truly represent, truly interpret, truly explain and give a true prediction; and
- there is finally a need to carry out in the correct way its activities of invention, intuition and discovery.

How will a mathematics teacher balance the mental with the spiritual in the teaching of mathematics? A true education must include God in all subjects and principles to produce the right men and women that this world needs.

As it is rightly put in a spirit of prophecy writing,

> " The greatest want of the world is the want of men - men who will not be bought or sold, men who in their inmost soul are true and honest, men who do not fear to call sin by its right name, men whose conscience is as true to duty as the needle to the pole, men who will stand for the right even if the heavens fall." [18, p 57]

Jesus also said, "And I, if I be lifted up from the earth, will draw all men unto me." John 12:32. Even in the Mathematics classroom therefore, Jesus must be lifted.

Allowing God even in our academics is what can keep one with hope in the Lord, because he alone is the source of all truth. Someone once said:

> " ... whenever my ideas contradict that of God as revealed in His word and in Christ, I surrender even if mine is more convincing than that of God".

This should be true of all academicians.

The bible and mathematics

According to Glyn Wooldridge in his paper in the book *The Opening of the American Mind*:

> The Mathematics in the Scripture occurs in a natural way in the form of numerical references to how many, to weights and measures, or to specific order. Few fractions occur; most numerical quantities are given in round numbers.[4, p. 176]

> Mathematics is used in the scriptures in various ways. God's people were "numbered"(i.e counted) on several occasions. They were numbered by Moses(Num 1:18; 26:1-4) and by David(II Sam 24:1-4). In Gen 15:5, God told Abraham to "look at the heavens and count the stars." [4, p175]

> The Bible is not a Mathematics text. The intricacies of Mathematical theories are not spelled out in the Scripture. However, some areas of Mathematics(geometry for example) were well developed at the time the Scriptures were written.
> .... Therefore, the Mathematical sciences have been and continue to be a part of God's general revelation to humanity...."(Gen 1:27) [4, p175]

Accuracy in reasoning can have an eternal effect whatever decision we make for good or for bad. The fact remains that God's influence on our life cannot be overlooked in whatever we do. Frank, E. G., quoting Pascal said,

> "The heart and not reason senses God. Which is true also in the spiritual. God created all and is the source of all truth."[6, p. 58]

Human reason, because of sin, is not perfect and cannot be totally trusted.

PURPOSE OF THE PAPER

Reflections on the error analysis in numerical computation in general give a parallel to man's situation while seeking salvation. Man, after the fall has tried several methods (following different principles and philosophies) to help humanity live right and enjoy love and unity.
No matter how good one method may be, it is not going to accomplish the goal, so far it is different from God's method of salvation which is the standard that exposes the errors in all other kinds of methods. In numerical computation several methods can be used, but there is always one that is the 'best', may be in terms of efficiency, reliability and core storage requirement accuracy, which does suggests the existence of 'errors' in the other methods.

By the title of this paper, "Mathematical Error: a Metaphor for Sin", I mean an implied comparison of mathematical error with sin. That is, a suggestion of likeness of mathematical error to sin. Sin by its nature has distorted alot of things in man like a particular error a mathematical computation can distort the expected result.

God is the source of all truths in man's experiences.
The diagram bellow illustrates the aim of this paper.

GOD

Academics	*Spiritual life*
Right/wrong	*Good/Evil*
Accurate results from mathematical computation	*Holy living*
Mathematical error	*Sin*
Distorted results	*Distorted judgement*
Unhappiness	*Unhappiness*
Error corrected by using the best method	*Salvation through Jesus the only way*
Happiness	*Happiness*

In this paper attempts will be made to bring out the absoluteness of truth as shown in some examples of numerical computation with the error analysis in comparison with the efforts made by the natural/carnal man to have salvation. This is aimed to be another example to set the mathematics teacher thinking so that he can better integrate faith and learning in the classroom.

EXPLANATION OF SOME TERMS

Numerical Methods:

This is any method for arriving at direct numeric answer to a problem without first producing a general solution in which numerical values can afterwards be substituted. They are often applicable to problems to which general solutions cannot be found, and are then calculated to required degree of approximation. Available for integrals, differential equations, polynomials and equations generally, and now of great importance since they can be programmed into digital computers.

Numerical Computation:

This refers to the use of Computers to solve mathematical problems involving real numbers.

Integration of Faith and Learning:

This, in a Mathematics classroom, can be seen as **"weaving both faith and learning into some kind of mutual acceptable relationship without the one assimilating or usurping the integrity of the other"**.

THE IDEA OF MATHEMATICAL ERROR

What is an error?

Basically this is **"an act involving a departing from the truth or accuracy, a mistake"**[17]. In mathematics, this is seen as the difference between a calculated value (generally of a physical quantity) and the true value.

This has actually fascinated me about it's reality in the human life as he makes efforts using different methods to find meaning to life and to God outside **JESUS** who is `the way and the truth`, John 14:6. According to Arthur F. Holmes **"All truth is God's truth"**.

Which means that, even truth in mathematical results is of God. This fact has answered the three fold loss of truth no matter where

it may be found according to him, namely:
- loss of focus on truth because people are not basically most of the time concerned about truth.
- loss of universality of truth because people readily adopt the view that the truth is relative.
- loss of unity of truth because it is not seen as interrelated and coherent whole.[7, p4-8]

ILLUSTRATIONS OF MATHEMATICAL ERROR

A. The first attempt to explain astronomical phenomena in mathematical terms was made by Euxodus, a pupil of Plato. His theory of homocentric spheres was the solution to a problem proposed by Plato to his pupils 'to save the phenomena', that is to account for the motions and the positions of the heavenly bodies. Euxodus proposed a solution inform of a mathematical model. But unfortunately as good as it was, it failed because it did not account for:

(a) Variations in the brightness of planets, especially Venus and Mars.
(b) the difference in size between the sun and the moon. [11, p709].

We see here an effort to eliminate computational errors.

B. The reality of accuracy in solution could also be seen in the efforts made in the computation of the potential gradients of the space below a static cylindrical thunder cloud from the ground level. It is generally accepted that clouds are bipolar. In order to make measurements of the potential gradient at points more than a few meters above the earth's surface, it is necessary to use some form of air-craft. But an air-craft with engine is not suitable because the exhaust gas(carbon monoxide) from the engine will react with the charged cloud thereby giving a faulty result.

Because the balloon can remain nearly stationary and because there are no engines which may produce separation of charges, it was initially found suitable for such measurements. However, the surface of the balloon is at least partially conducting and so the field is distorted by the presence of the balloon and corrections are therefore also needed. Also, the balloon, apart from possible error of distortion of the field in the cloud, cannot go too far. Thus the balloon cannot also be used for accurate results.

Thus, there is a need for a better method for a dependable result to be obtained - a search for the truth. As a part of the efforts being made to control this error, a mathematical

model of this problem was developed by A.I.I.Ette and G. O. Olaofe in 1982 from which Olaofe came up with a simplified equation which could be computed to obtain potential gradients at any point from the ground under a static cylindrical thunder cloud in space.

The equation is given as :

$$\Phi = \frac{\rho}{4\pi\epsilon_o} \int_{h_1}^{h_2} d\eta \int_0^a r dr \int_0^{2\pi} \frac{d\theta}{(u^2 + r^2 - 2urCos\theta + (\eta - z)^2)^{\frac{1}{2}}}$$

where ϵ_o is the permitivity of free space, and u and z denote the radial and vertical(axial) distances of the observation point from the origin. Φ is the scalar potential.
For any cylinderical thunder cloud in free space the above is an exact solution of the Poisson's equation : $\nabla^2\Phi(r,z)= 0$. Olaofe did alot of work simplifying this exact equation by putting it in terms of rapidly convergent series which makes the solution particularly suitable for calculation on microcomputers to reduce labour and cost.

C.   Input values are seldom exact, since they are often based on experiments or estimates, and the numerical processes themselves introduce errors of various types. Thus, the numerical analysts are concerned with controlling the errors in the computed results - attainable by using the right methods and right discretization parameters. This is clearly suggesting that there is a truth been sought.

(i)   For example,
      finding the roots of the equation:

      $$x^2 + 0.4002x + 0.00008 = 0,$$

      using four digit floating point arithmetic.

      Using the formula $x = (-b \pm \sqrt{b^2 - 4ac})/2a$, we get an answer of - 0.00015. This formula is usually presented in algebra courses without any qualification of it's accuracy, yet errors are introduced by the four - digit floating point arithmetic that make the result to be wrong by 25%; the true root, found with eight - digit arithmetic, is -0.0002. Even though the culprit in this case was the four-digit arithmetic, it does not mean that eight -digit floating point numbers solve all problems.

(ii) Consider another example, the Taylor series for the sine

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots$$

This series is, in theory, valid for any finite angle, and the truncation error committed by stopping the summation after a finite number of terms is less in absolute value than the first term neglected.   i.e
$o(h) < |X_{n+1}|$
These statements are true if there were some way to keep infinite number of digits in each arithmetic result.

(iii) A final example, is the integral

$$\int_{e^{-4}}^{1} dx/x \qquad = [\ln x]_{e^{-4}}$$

which has an exact value 4. Yet integrating with the familiar Trapezoidal rule, using 10 intervals, gives a result of 5.3. Even using 40 intervals we get 4.13, off by 3%. (the problem is with the integrand which is very large with small x, and in the numerical process). With exact data and exact calculations we still get a large error from the nature of the function and of the numerical technique employed.

According to Arthur Holmes,

> " Human error haunts man's quest for truth as relentlessly as sin and finiteness attend his search for justice and compassion. Error creeps into our moral and political judgements, or theology, our history, our science,..... Error is like evil. As evil is to good, so error is to truth. It is a negative feature, a violation or a failure. Philosophers often speak of evil as a privation of the good: error is analogously a privation of the truth. ....It is cognitive evil: the good which the understanding seeks is truth, and the evil it struggles to avoid is error."
> [7, p49]

SOURCES/TYPES OF MATHEMATICAL ERROR
AND INTEGRATION OF FAITH

"Precise measurement lies at the very heart of science." [11, p709]. There are several sources of error in numerical computation techniques in mathematics. Such errors are evident in man's(natural/carnal) attitude to salvation, as discussed below.

Local/Absolute error:

The local error(or relative error) is the error of a single step only, while the accumulation of these is termed absolute error. The absolute is also described as the global error. Metaphorically speaking, the disobedience of Adam and Eve has led to an original sin inherited by all which is now global. There is also the individual sin which is local or relative and must be corrected also. As Jesus the truth is the one who gives the correct wisdom to choose the correct technique that will take care of any of this errors during computation, He is also the true solution to the sin problem.

Consider the example below:

$$F(x) = a_0 + a_1x + a_2x^2 + a_3x^3 + \ldots + a_nx^n + a_{n+1}x^{n+1} + \ldots$$

The value of the term $a_{n+1}x^{n+1}$ gives the local error while the sum of all the values of the infinitely many term from n+1 term will give the absolute error which can be corrected using an appropriate method depending on the problem.

This idea could also be seen this way: if x is the true value, x' is the approximate value and e_x is the error then $x = x' + e_x$. Here the absolute error is e_x and the relative or local error is given as the absolute error divided by the approximation. This is true of the statement in the word of God that **"righteousness exalteth a nation but sin is reproach to a people"** Prov.14:34. Imagine the global effect of the sin of many, on towns/cities, countries and the whole world today!

System errors:

These are the errors which are not easy to detect in numerical analysis. They result reproducibly from faulty calibration of equipment or from bias on the part of the observer. This is true of the natural man who claims to be sincere but may be sincerely wrong in his approach to salvation, because there is something that is basically wrong in him. This also represents the state of a Christian who is hypocritical – false appearance. e.g measuring the length of a table with a steel meter stick calibrated at 25°C with an expansion coefficient of $0.0005/^\circ$C. If the measurement is done at 20°C the reading will be 1.983m, which will not be right. The correct answer will be obtained by multiplying the result with $1 - 5(.0005) = 0.9975$ so that the new result is 1.977m.

A mind not directed by the Holy Spirit will not see the true way out of sin in JESUS.

Inherent errors :

Are in the values of data, caused by uncertainty in measurements or by outright blunders(human error in using computational machines) or by the necessarily approximate nature of representing some finite number of digits a number that cannot be represented exactly in the number of digits available. Like the Moslems claim that good works can help us find favour with God, not knowing that " the way of man is not in himself: it is not man that worketh to direct his steps" Jer.10:23. As care is the remedy to this kind of mathematical error, which is only certain as God directs, dependence on God is the way out for man. The inherent errors can also be seen as the error in original data. Real world problems, in which an existing or proposed physical situation is modelled by a mathematical equation, frequently have coefficients that are imperfectly known.

Truncation/Round-off errors:

These are errors introduced by numerical procedures themselves. Like the Pharisees(who studied the commandments of God and came up with wrong inferences and interpretations), the Scribes and the religions of man as will be presented later, because of "truncation and round-off errors" in their methods they could not see the truth as it is of God as the way out of sin.

e.g $\quad \sin x = x - \dfrac{x^3}{3!} + \dfrac{x^5}{5!} - \dfrac{x^7}{7!} + \ldots,$

a familiar infinite Taylor series may be used to calculate the sine of any angle in radians. Since all the terms cannot be used, a finite number of terms must be selected, the omitted terms (which are infinite) will introduce what is described as **Truncation error**. The choice of method is our best control here.

Since we can carry only finite number decimal places, our computations are subject to inaccuracy from this source, no matter whether we round or whether we chop off. Carrying more decimal places than we require is the normal practice to minimize this. This type of error is especially troublesome when two nearly equal quantities are subtracted, as in all the methods of man demonstrated in the religions mentioned above - they are all similar and thus it becomes more difficult for him to see reason in God's wisdom.

Propagated errors:

This is more subtle than the other errors. This is the error in the succeeding steps of the process due to the occurrence of an earlier error. In real world situations, we can see some wrongs or evil passed on in some family as if it was inherited by birth, e.g

stealing. This can be broken by just a member of the family accepting God's plan. Stable methods are used in numerical computation in which the errors die off, unlike the unstable method which magnifies the errors to the extent that the true value is overshadowed.

MAN'S RELIGIONS: EFFORTS IN SEARCH FOR SALVATION

Since the fall of man, he has made several efforts to find salvation and to live well following all kinds of principles and philosophies which because they are different from God's solution may appear to be helpful but will for ever remain inadequate - since ERRORs exist.
Some of the efforts are as revealed in the examples of the religious systems, which are given below. This is similar to what happens in mathematical computation as man struggles with all kinds of errors, as he is searching for accuracy of results.

Islam:
Teaches that salvation consists merely in deliverance from punishment and that good works can help man to find favour with God. While this religion still denies with emphasis the incarnation of the son of God - "the truth and the way", it still represents faith as intellectual and mere accent to the Kalima:- "There is no God but God, and Mohammed is his prophet." [9] Can any goodness come from a sin tainted man? This is an error of assumption.

Hinduism:
Teaches that the means of salvation are two ways , namely: the gyàn màrg, or "the way of knowledge", and bhakti màrg, or "the way of devotion", while still acknowledging God.[9] Ignores Christ and his sacrifice.

Buddhism:
Teaches that every man must be his own saviour. Salvation is by practice of certain good works and that God's input is not necessary. Self- rigteousness. [9]

Confucianism:

S. H. Kellog said,

> "As for Confucianism,it cannot be said to have a doctrine
> of salvation. Confucius concerned himself exclusively
> with this present life; and ignoring God and our relation
> to him...." [9, p89].

But Jesus said that He is "...the way and the truth...",John14:6. and the bible says ," There is a way that seemeth right unto a man, but the end there of are the ways of death." [Prov.16:25]

THE ISSUE OF SIN AND SALVATION

God meant that life will be meaningful and happy for man when He created him. But along the way because of disobedience sin came in, and since then man has been making all kinds of efforts to have the former relationship restored even though God has laid down the plan for this, which is revealed in JESUS, the truth.

The presence of this sin in man is like a computer virus which has been causing all kinds abnormalities revealed in fruitless efforts to make things go better. Man is even confused about the nature of sin as there are various understandings among groups.

But, what is salvation?

This can be simply put as the experience of freedom/deliverance from sin and it's presence. This freedom results in right living and good relationship with God.

Why are so many not finding this salvation?

"Human error haunts man's quest for truth as relentlessly as sin's finiteness attend his search for justice and compassion."(ibid.) Every human being does not react to the truth in the same way. The Bible has rightly classified all human being into three groups, two of the groups having their errors. The groups are:

NATURAL MAN

This is the man after sin came into the world who has not received Christ.
Characteristic:
- neither knows nor accepts the truth;
- Ego or finite self is on the throne;
- Christ is outside the life;
- Interests are directed by self, often resulting in discord and frustration.

CARNAL MAN

This is the man after sin came into the world, who has received Christ but lives in defeat because he trusts in his own efforts to live the christian life.
Characteristics: He lives a self directed life.
- Self is on the throne.
- Christ is dethroned and not allowed to direct the life.
- Interests are directed by self which often leads to discord and frustration.

SPIRITUAL MAN

This is the man after sin came into the world, who is directed and empowered by the Holy Spirit because he is living a Christ centered life.

Characteristics:
- Christ is in the life and on the throne
- Self is yielding to Christ
- Interests are directed by Christ, resulting in harmony with
  God's plan. [19, p2-3]

CONCLUSIONS AND SUMMARY

In this paper I have tried in a simple way to discuss the idea of
mathematical error - sources/types and efforts in solutions used to
correct or reduce these errors. It is a fact that in mathematical
computation, accuracy is paramount, this is the goal, it is a truth
that the best method must be applied to accomplish this. This
experience in numerical computation is used as a metaphor to
illustrate the situation of man in his search for meaning in life
since the fall. All kinds of efforts have been made by man to live
well as shown in the kinds of religion and the personalities
exhibited. I also dicussed the inherent error(like the inherited
sin in a natural man which requires a special intervention to
correct). Other errors are system error, round-off and truncation
error, etc. In all, whether in the struggle for accuracy of result
in mathematical computations or in the struggle to overcome sin,
the truth is absolute and it is only in God.

According to J.L Shuler
> "In our search for the real truth for our day we must
> remember that instinct may deceive , reason may mislead,
> psychic phenomena may sweep one into wrong conclusions,
> science may err; but God's word can be trusted completely
> because it is infallible truth."

He further said,
> "the difference between being saved and being lost is in
> getting hold of the right thing. In religion everything
> depends on getting hold of the truth as it is in Jesus".

I say also, in numerical computation, the difference between
getting accurate result and wallowing in mathematical error depends
on getting the right method and principles through the right
knowledge, which is only in God- as it is written, "If any of one
lack wisdom let him ask of God, that giveth to all men liberally
and upbraideth not and it shall be given him" James 1:5. It is
also said in Proverbs: "Trust in the Lord with all thine heart and
lean not unto thine own understanding. In all they way acknowledge
him and he shall direct they paths" Prov. 3:5-6.

It is a clear fact that truth is absolute as in God. Therefore, let
us not only trust Him for salvation from sin and its presence, let
us also trust Him for accuracy in mathematical computation and let
us integrate this in our teaching in our Mathematics classrooms

BIBLIOGRAPHY

1. BRIAN J.WALSH and RICHARD J. MIDDLETON, The Transforming Vision; Shaping a world View Downers Grove IL.; Intervarsity Press, 1984.

2. CURTIS F. GERALD, Applied Numerical Analysis, 2ed, Addison-Wesley Publ. Company, 1978.

3. DAVID F. ROGERS and P. R. SMITH (Editors), Computers and Education: An International Journal Vol.13 No 1 1989, Pergamon Press.

4. DAVID W. BECK Opening The American Mind: The Integration of Biblical truth in the Curriculum of the University. Baker Book House company, 1991.

5. Ette A.I.I. and G.O. Olaofe, Theoretical field Configurations for Thunder Cloud Models With Volume Charge Distribution, a paper PAGEOPH, Vol. 120, 1982.

6. FRANK E. GAEBELEIN, The Pattern of God's Truth: Problems of Integration in Christian Education. BMH Books, 1968.

7. HOLMES,A.F.All Truth is God's Truth, Wm. B. Eermans Publ. Co., 1977.

8. IRVING G.LOGAN, Ministering to the Secular Student in a Christian College, ICT 1988.

9. KELLOG S. H. , A Handbook of Comparative Religion, The Wesminster Press, 1940.

10. KING JAMES VERSION, The Holy Bible.

11. MELVIN MERKEN, Physical Science with Modern Applications. Saunders College Publ. pg 709.

12. OLAOFE G.O. , An Unpublished Paper.

13. PHILIP R. BEVINGTON, Data Reduction and Error Analysis for the Physical Science. McGraw Hill Book Company. 1969.

14. SHULER J. L. , The Search for Truth, R & H Publ. Ass. 1979.

15. SIMEON OLA FATUNLA (Editor), Computers and Mathematics in the Modern Society , Macmillan Nig. Publ. Ltd. 1985.

16. South Pacific Division Department of Education, Mathematics: SDA Secondary Curriculum. Silver Spring,MD:ICT, 1990.

17. WEBSTER'S New Collegiate Dictionary, G & C. Merriam Co., 1960.

18. WHITE E. G.; Education, Pacific Press Publ. Ass. Mountain View, Calif. 1952.

19. WILLIAM R. BRIGHT, Have you made the wonderful discovery of the spirit- filled life? Campus Crusade for Christ, Inc.; 1966.

20. WILLIAM S. DORN AND DANIEL D. MCCRACKEN, Numerical Methods with Fortran IV Case Studies, John Wiley & Sons,Inc. 1972.

21. WOUDENBERG SINIKA A. L., A model for integrating the christian Faith and the Scientific Mind Set, ICT ,1989.