UNIVERSITY OF ILORIN

THE TWO HUNDRED AND FORTIETH (240TH) INAUGURAL LECTURE

"MATHEMATICS IS FOR ALL"

By

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My Lords, Spiritual and Temporal,
My Dear Students of Mathematics and other students here present,
Gentlemen of the Print and Electronic Media,
Friends and Relations,
Distinguished Invited Guests,
Great Unilorites,
Members of my family-nuclear and extended, and
Distinguished Ladies and Gentlemen.

Preamble

Oh God, but for You, where would I have been today. To God alone be all the glory, power and adoration for counting me worthy to deliver this lecture. All praise to the Lord God of Heaven, the Great and Terrible God, who keep covenant and mercy for them that love Him. Indeed, in His favour He had mercy on me.

Getting Started

Vice-Chancellor sir, I believe that it was ordained by God that I will be a Mathematician. My teachers quarreled on the choice of subjects I needed to choose in Form Four when I was in Secondary School; Art, Science or Commercial because I always collect the prize for the first position virtually in all the subjects. However, a letter was given to me to take home, imploring my parents to decide the subjects I would study. The decision of my parents settled the problem among my teachers. After the completion of my secondary school, I went to Oyo State College of Arts and Science (OSCAS), Ile-Ife for Higher School Certificate (H.S.C.). My set was the last set of H.S. C. in Nigeria in 1989. I remembered the day we wrote Mathematics Examination during the H. S. C. programme because the external invigilator shook his head on tearing the envelope which consists of question papers. This action affected our moral as we were about to start the examination. Some students were crying during this examination but I forged ahead and I made it. This programme made me stronger academically.

I chose to study Mathematics in the University of Ibadan. It looks as if I was foolish in choosing such a career to some people. Somebody said "Are you insane?" just because of the choice of study that I made. Another one said, even men started studying Mathematics but they could not complete it. "What are you looking for in Mathematics?". When I entered the University of Ibadan, a senior friend who entered University of Ibadan before me told me that I will graduate with first class asterik if I study like the way I did during the H. S. C. programme. Eventually, I had a **F*irst Class*** on the completion of my first degree at the University of Ibadan, Ibadan, Nigeria; in spite of the stigma, ***Mathematics is for all.*** Thanks be to God and for my parents who believed in me.

Vice-Chancellor sir, my dream was to become a teacher maybe in secondary school but as I grew, my dream changed to becoming a teacher and a researcher (lecturer). During the National Youth Service Corps (NYSC) programme, First Bank

Plc, requested for the best graduating student from my Department to offer me a job. I did not take the job because of my dream.

Introduction

Vice-Chancellor sir, this Inaugural Lecture is the seventh from the Department of Mathematics, Faculty of Physical Sciences and the first from a female Professor of Mathematics in this University. There are two areas of Mathematics-Pure and Applied Mathematics. Pure Mathematics involves the use of pure numbers while applied Mathematics involves quantities such as numerical values and units of measurement. Applied Mathematics is used in practical applications in day-to-day life while pure Mathematics is the study of principles without much practical application. Fields such as Computer Science, Engineering, Physics e.t.c are Applied Mathematics. Pure Mathematics encompasses the study and research of theories and abstract Mathematical concepts. It forms the basis of Applied Mathematics which is also called Mathematical sciences. Pure Mathematics consists of Functional Analysis, Complex Analysis, Real Analysis, Algebra, Topology and Theory of Measure.

My areas of specialisation are Complex Analysis-Geometric Function Theory and Functional Analysis-Self Adjoint Operator Algebras. Recently, I focused more on Geometric Function Theory. Complex Analysis is an important component of the mathematical landscape, unifying many topics from the standard undergraduate curriculum. It can serve as an effective capstone course for the Mathematics major and as a stepping stone to independent research or to the pursuit of higher Mathematics in graduate school. It is concerned with the study of complex-valued functions of a complex variable. Complex exponential is used in the definition of some special functions. Complex numbers have applications in many fields of mathematical sciences and can be used to solve real-world problems. Functions are very important part of Mathematics. A function acts as the link between a set of input and output values, such that if you pass a certain input value through a given function, it will always yield one specific output. Function can be defined as a special relation which maps each element of set A with one and only one element of set B. Both the sets A and B must be non-empty. A function defines a particular output for a particular input. Hence, $f : A \to B$ is a function such that for $a \in A$ there is a unique element $b \in B$ such that $(a, b) \in f$.

Complex Function

A complex function is a function from complex numbers to complex numbers. In other words, it is a function that has a subset of the complex numbers as a domain and the complex numbers as a co-domain. Complex functions are generally supposed to have a domain that contains a non-empty open subset of the complex plane. For any complex function, the values z from the domain and their images $f(z)$ in the range may be separated into real and imaginary parts.

$z = x+iy$ and $f(z) = f(x + iy) = u(x, y) + iv(x, y)$

where x, y, u (**x**,y), v(x,y) are all real valued. A complex function f : C → C may be decomposed into $u: R^2 \to R$ and $v : R^2 \to R$, i.e. into two real-valued functions (u,v) of two real variables (x,y).

The set S is a subset of the complex numbers and is called the domain of definition of *f*. The unique complex number $f(z)$ is called the value of f at z and is sometimes written w = f(z). A function is single valued if for each of *z*, there is only one value of *w*, otherwise it is multiple valued or many valued. In general, we can write $w = f(z) = u(x, y) + iv(x, y)$ where u and v are real functions on *x* and *y*. In other words, *a complex-valued function* f *of complex variable is* a *relation that* ass*igns* to *each complex number* z *in* a *set* S a *unique complex number* $f(z)$. For example, the function $f(z) = z^3$ assigns to each complex number z the complex number $w = z^3$. When a function is given by a formula and the domain is not specified, the domain is taken to be the largest set on which the formula makes sense. For instance, the domain of $f(z) = z^3$ is the set of all complex numbers *C*, while the domain of $g(z) = (z^2 - 1)^{-1}$ is *C* except (−1, 1).

In calculus, a real-valued function $y = g(x)$ of a real variable x is represented as a graph in the (x, y)-plane. The graph provides a pictorial representation of the function and its properties and contains vital information. To visualize a complex-valued function $z \to f(z)$ requires four dimensions: two dimensions for the variable z and two for the values $w = f(z)$. Since a four-dimensional picture is not possible, we use two planes, the z-plane and the w-plane, and view the function as a mapping from a subset of one plane to the other.

Geometric Function Theory

Geometric Function Theory (GFT), a branch of complex analysis is the **study of geometric properties of analytic functions**. It is an area of Mathematics that combines geometry and analysis. GFT provides new weapons to use on traditional problems. Problems are rendered transparent by way of geometric language approach to function theory. Geometric functions are very useful in the analysis of practical problems of hydrodynamics, aerodynamics, elasticity and the natural sciences. The cornerstone of GFT is the univalent functions, but, today many related topics have been established. That is, the theory of univalent functions is the foundation stone for GFT. One of the major interests in GFT is finding the coefficient bounds of univalent functions. These bounds provide useful information on the geometric properties of analytic functions. The bounds determine the growth, distortion properties among others of the analytic function.

The Essence of Geometric Function Theory

In 1916, Bieberbach gave a conjecture which became one of the most celebrated conjectures in Mathematics. The understanding of the solution of the Bieberbach conjecture given by de Branges in 1984 presents a challenge to postgraduate students and researchers. The solution employed non-elementary methods in several branches of analysis. Riemann Mapping Theorem is an important theorem in the study of GFT. The theorem established that any simply connected region of the complex plane other than the plane itself is conformally equivalent to the open unit disk.

Riemann Mapping Theorem: Let ω be a simply connected region in the complex plane other than the complex plane itself. Then there is a one-to-one analytic function f that maps ω onto the unit disc $|\omega| < 1$. The mapping f is unique if we specify that $f(z_0) = 0$ and $f'(z_0) > 0$, for some z_0 in ω.
Now, we look at the basic concepts in Geometric Function Theory.

Univalent Functions: A single-valued function f is said to be univalent in a domain $D \subset C$ if it never takes the same value twice, that is, $z_1 \neq z_2$ ∀ points z_1, z_2 in D with $f(z_1) \neq f(z_2)$. In other words, a function $f(z)$ is said to be univalent in a domain D if the conditions $f(z_1) = f(z_2)$, $z_1,\ z_2 \in D$ imply that $z_1 = z_2$. Univalent functions are also called simple, schlicht (the German word for simple) or odnolistni (Russian word for single-sheeted). The class of univalent functions and some of its subclasses are defined by some geometric conditions. Consequently, the term univalent carries with it the connotation that a function is also analytic. In the theory of univalent functions, certain assumptions are made. The most obvious one is to replace the arbitrary domain D by the unit disk $U{:}\,|z| < 1$ for convenience.

Normalised Univalent Function: Let the Maclaurin series of $f(z)$ be analytic in U and is given by

$$f(z) = \sum_{n=0}^{\infty} a^n z^n \qquad (1)$$

Normalising (1),

$$f(z) = z + \sum_{n=2}^{\infty} a^n z^n \qquad (2)$$

A function of the form (2) is said to be normalised. We denote by A, the class of functions analytic and normalised by the conditions $f(0) = 0$ and $f'(0) = 1$.The class of all normalised functions that are analytic and univalent in the unit disk U, is denoted by S (simple, schlicht). The Koebe function,$k(z) = \frac{z}{(1-z)^2} = z + \sum_{n=2}^{\infty} nz^n$ is a well known example of the class S.

Subclasses of Univalent Functions

Here, the basic subclasses of univalent functions are defined. Starlike and convex functions are the most important subclasses of S. Many ideas and methods of proof in univalent functions theory were discovered in the study of these subclasses. In other words, other classes developed by researchers are discovered while studying these classes. The new classes developed always find their roots in these natural subclasses of S. They are the natural subclasses of S.

Starlikeness: A set D ⊂ C is said to be starlike with respect to a point $w_0 \subset D$ if the linear segment joining w_0 to every other point $w \subset D$ lies entirely in D, that is, a set D is starlike with respect to $w_0 \subset D$ if $w \subset D \Rightarrow (1-t)w + tw_0 \in D \; \forall \, t \in [0, 1]$

If D is starlike with respect to the point $w_0 = 0$, we simply say D is starlike.

A function $f(z)$ is said to be starlike with respect to a point w_0, if it maps U onto a domain that is starlike with respect to w_0.

Starlike function: The normalised univalent function $f(z)$ is said to be starlike of order

α in U if $\forall \, z \in U$,

$$Re \left\{ \frac{zf'(z)}{f(z)} \right\} > \alpha, 0 \leq \alpha < 1$$

Denote by S^* the subclass of S consisting of starlike functions.

Convexity: The set D is said to be convex if it is starlike with respect to each of its points; that is, if the linear segment joining any two points of D lies entirely in D, that is, a set D is convex if

$$w_1, w_2 \in D \Rightarrow tw_1 + (1-t)w_2 \in D \; \forall \, t \in [0,1]$$

A function $f(z)$ is said to be convex if it maps U onto a convex domain.

Convex function: The normalised univalent function $f(z)$ is said to be convex of order

α in U if $\forall \, z \in U$,

$$Re\left\{\frac{zf''(z)}{f'(z)}\right\} > \alpha, 0 \leq \alpha < 1$$

The subclass of S consisting of convex functions is denoted by K.

Thus, $K \subset S^* \subset S$

Close-to-Convex function: The normalised univalent function $f(z)$ is said to be close-to-convex if there is a convex function $g(z)$ such that:

$Re\left\{\frac{f'(z)}{g'(z)}\right\} > 0 \; \forall \, z \in U$

Each $f \in S^*$ has the form $f(z) = zg'(z)$ for some $g \in K$.

Therefore,

$$Re\left\{\frac{zf'(z)}{f(z)}\right\} > 0,$$

α **- Convex function:** α - Convex function combines convex and starlike functions in terms of linear expression of the functionals:

$1 + \left\{\frac{zf''(z)}{f'(z)}\right\}$ and $\left\{\frac{zf'(z)}{f(z)}\right\}$

to produce a generalisation of the starlike and convex functions.

The normalised univalent function $f(z)$ is said to be α -Convex in U if and only if it is regular,

$Re\left\{\frac{f(z)}{z}f'(z)\right\} \neq 0$ and $Re\left\{\alpha\left(1+\frac{zf''(z)}{f'(z)}\right) + (1-\alpha)\frac{zf'(z)}{f(z)}\right\} > 0 \; \forall \, z \in U$ and $\alpha \in R$

Remark:

(i) If $\alpha = 1$, an α - convex function is convex

(ii) If $\alpha = 0$, an α - convex function is starlike

Alexander's Theorem: Let $f(z)$ be analytic in U, with $f(0) = 0$ and $f'(0) = 1$. Then $f(z)$ is convex if and only if $zf'(z)$ is starlike. This theorem connects starlikeness and convexity.

Noshiro-Warschawski Theorem: Suppose that for some real α we have $Re\left(e^{i\alpha} f'(z)\right) > 0 \; \forall \, z$ in a convex domain D. Then $f(z)$ is univalent in D.

The following theorems give the analytic descriptions of starlike and convex functions.

Theorem 1: Let f be analytic in U, with $f(0) = 0$ and $f'(0) = 1$. Then $f \in S^*$ if and only if $\frac{zf'(z)}{f(z)} \in P$

Theorem 2: Let f be analytic in U, with $f(0) = 0$ and $f'(0) = 1$. Then $f \in K$ if and only if $[1 + \frac{zf''(z)}{f'(z)}] \in P$

The sharp bound for $|a_n|$ when $f(z)$ is in the class S has been solved for the subclasses S^* and K.

Theorem 3: If $f(z)$ given by (2) is in S^*, then for each positive integer n, $|a_n| \leq n$

Further, this inequality is sharp for each index n, and if equality occurs for just one $n \geq 2$, then $f(z)$ is a rotation of the Koebe function.

Theorem 4: If $f(z)$ given by (2) is in K, then for each positive integer n, $|a_n| \leq 1$. Further, this inequality is sharp for each index n, and if equality occurs for just one $n \geq 2$, then $f(z)$ is a rotation of $\frac{z}{1-z}$.

Maximum Principle and Schwarz lemma: The maximum principle is a powerful tool for obtaining bounds on the size of analytic functions. Schwarz lemma given by Hermann Schwarz (1843-1921) is a simple but important consequence of the maximum modulus theorem. Schwarz lemma is a statement about the rate of growth of analytic functions on the unit disk.

Maximum Principle: Let a function$f(z)$ be analytic in a domain D and continuous in a closed domain$\overline{D}$. Then, either $f(z)$ = constant or $|f(z)|$ attains maximum values on the boundary of the domain.

Schwarz Lemma: Let$f$ be analytic in the unit disk U, with $f(z) = 0$ and $|f(z)| < 1$ in U. Then, $|f'(0)| \leq 1$ and $|f(z)| \leq |z|$ in U. Strict inequality holds in both estimates unless f is a rotation of the disk: $f(z) = F(z) = e^{i\theta}$.

Subordination Principle is a consequence of Schwarz lemma.

Subordination Principle: A function f on the unit disk is said to be subordinate to a function g (in symbols $f(z) \prec g(z)$ in the unit disk U if there exists an analytic function $w(z)$ with $w(z) \leq |z|$ in U such that $f(z) = g(w(z))$ in U. If g is univalent in U, $f(0) = g(0)$ and $f(U) \subset g(U)$.
This is called the subordination principle or Lindelȯff's principle.

Bieberbarch's theorem provides sharp lower and upper bounds of $|f(z)|$ and $|f^{'}(z)|$ referred to as growth and distortion theorems respectively.

Bieberbach's Theorem: If $f(z) \in S$, then $|a_2| \leq 2$. Equality holds if and only if f is a rotation of the Koebe function.

Bieberbach's Conjecture: If $f \in S$, then $|a_n| \leq n$ for any integer $n \geq 2$. Equality holds if and only if f is a rotation of the Koebe function.

However, because of the extremal properties of the Koebe function, many mathematicians made this same conjecture for different classes of univalent functions. This conjecture is referred to as the "central conjecture" in the theory of univalent functions or as the "coefficient conjecture". The conjecture has been proved in many special cases.

Polynomial Function

A polynomial function is defined by $y = a_0 + a_1 z + a_2 z^2 + ... + a_n z^n$, when n is a non-negative integer and $a_{0,} a_1, ..., a_n$ are the coefficients. The highest power in the expression is the degree of the polynomial function. Polynomial functions are further classified based on their degrees:

i. Constant Function: If the degree is zero, the polynomial function is a constant function.
ii. Linear Function: The polynomial function with degree one.
iii. Cubic Function: A cubic polynomial is a polynomial of degree three and can be denoted by $f(z) = az^3 + bz^2 + cz + d$, where $a \neq 0$ and $a, b\ c, d$ are constants and z is a complex variable.

iv. A rational function is any function of the form $\frac{f(z)}{g(z)}$ in which numerator, $f(z)$ and denominator, $g(z)$ are polynomial functions of z, where $g(z) \neq 0$.

v. Quadratic Function: If the degree of the polynomial function is two, it is a quadratic function. It is expressed as $f(z) = az^2 + bz + c$, where $a \neq 0$ and a, b, c are constants and z is a complex variable. The domain and the range are C.

Special Functions

Vice- Chancellor sir, Special functions are some particular mathematical functions which have more or less established names and notations due to their importance in mathematical analysis, functional analysis, physics or other applications. However, there is no general formal definition, but the list of mathematical functions contains functions which are commonly accepted as special. A special function is a function (usually named after an early investigator of its properties). Special function can also be defined as means of power series, generating function, infinite product repeated differentiation, integral representation, differential difference, integral and functional equation, trigonometric series or other series in orthogonal functions. The theory of special functions has been developed essentially in the nineteenth century. However, in the twentieth century the theory of special functions has been overshadowed by other fields such as real and functional analysis, topology, algebra and differential equations. Special functions and polynomials such as Exponential Function, Beta Function, Gamma Function, Bessel Function, Legendre polynomial, Chebyshev polynomial, Gegenbauer polynomial, Horadam polynomial, Bernoulli polynomial and activation function are useful in solving real life problems.

Sigmoid Function

The sigmoid function is a mathematical function having an "`S"' shape (sigmoid curve) as shown in Figure 1. Often, sigmoid function refers to the special case of the logistic function and it is defined by the formula: $\emptyset(z) = \frac{1}{1+e^{-z}} = \frac{e^{z}}{e^{z}+1}$.

Sigmoid function is useful because it is differentiable, which is important for the weight- learning algorithms. The sigmoid function has very important properties: It

i. outputs real numbers between 0 and 1

ii. maps a very large input domain to a small range of outputs

iii. never loses information because it is a one to one function.

iv. increases monotonically.

It has derivative $\frac{d\emptyset}{dz} = \frac{e^{-z}}{(1+e^{-z})^{2}}$

It has Macluarin's series $\emptyset(z) = \frac{1}{2} + \frac{z}{4} - \frac{z^{3}}{48} + \frac{z^{5}}{480} - \frac{17z^{7}}{80640}$

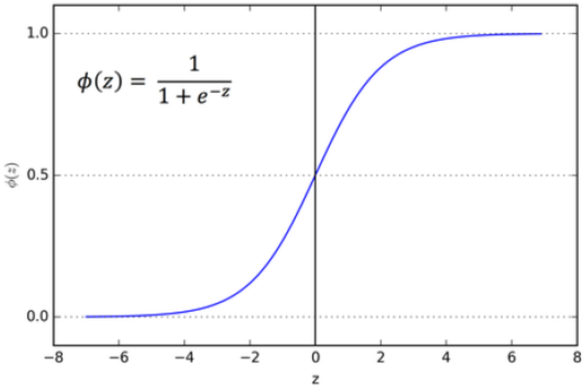

Fig. 1 : Sigmoid function

The sigmoid function is an activation function that scales values between 0 and 1.

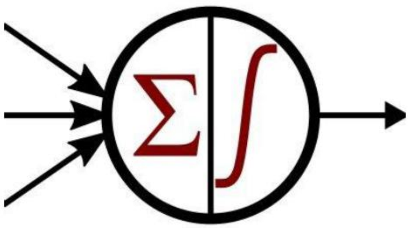

Fig. 2: Input-Output

Derivation of the Sigmoid Polynomial

The sigmoid polynomial can be derived using the Macluarin's series

$$f(z) = f(0) + zf'(0) + \frac{z^2}{2!}f''(0) + \frac{z^3}{3!}f'''(0) + \cdots$$

$$f(0) = \frac{e^0}{e^0 + 1} = \frac{1}{2}$$

$$f'(z) = \frac{(1 + e^z)e^z - (e^z)e^z}{(e^z + 1)^2} = \frac{e^z}{(e^z + 1)^2}$$

$$f'(0) = \frac{e^0}{(e^0 + 1)^2} = \frac{1}{4}$$

$$f''(z) = \frac{(1 + e^z)^2 e^z - 2e^z(e^z)(1 + e^z)}{(e^z + 1)^4} = \frac{e^z(1 - e^z)}{(e^z + 1)^3}$$

$$f''(0) = \frac{e^0(1 - e^0)}{(e^0 + 1)^3} = 0$$

$$f'''(z) = \frac{(1 + e^z)^3(e^z - 2e^{2z}) - 3e^z(e^z - e^{2z})(1 + e^z)^2}{(e^z + 1)^6}$$

$$f'(0) = \frac{2^3(-1) - 3(0)(1 + 1)^2}{2^6} = \frac{-8}{64} = \frac{-1}{8}$$

$$f^{iv}(0) = \frac{(1+e^z)^6[(1+e^z)^3(e^z-4e^{2z})+3(e^z-2e^{2z})e^z(1+e^z)^2]}{(e^z+1)^{12}} - \frac{(1+e^z)^6\begin{bmatrix}(3e^z(e^z-2e^{2z})2e^z(1+e^z)+3e^z(1+e^z)^2(e^z-2e^{2z})\\ +3e^z(e^z-e^{2z})(1+e^z)^2\end{bmatrix}}{(e^z+1)^{12}}$$

$$-\frac{[(1+e^z)^3(e^z-2e^{2z})-(3e^z(e^z-e^{2z})(1+e^z)^2]}{(e^z+1)^{12}} = \frac{e^z}{(e^z+1)^2}$$

$$f^{iv}(0) = \frac{2^6[(2^3(-3)+3(-1)(2)^2]}{2^{12}} - \frac{(1+1)^6[(3(1-2)2(1+1)+3(1+1)^2]}{(1+1)^{12}} - \frac{(1+1)^3(1-2)-3(1-1)(1+1)^2]6(1+1)^5}{(1+1)^{12}}$$

$$f^{iv}(0) = \frac{2^6[-24-12]}{4096} - \frac{2^6[12]}{4096} - \frac{8[192]}{4096} = \frac{-1536+1536}{4096} = 0$$

and so on.
Inserting the above derivatives, we have

$$\emptyset(z) = \frac{1}{2} + \frac{z}{4} - \frac{z^3}{48} + \frac{z^5}{480} - \frac{17z^7}{80640} + \frac{31z^9}{1451520} - \cdots$$

Significance of the Sigmoid Function

The sigmoid function can be used in

1. the hardware implementation of the artificial neural network
2. probability and statistics, biology, demography, population dynamics, ecology and mathematical psychology
3. the study of performance growth in manufacturing and service management
4. modeling the growth of tumors or to study pharmacokinetic reactions
5. prediction of site index for forestry
6. computer graphics or image processing.

Salagean Differential Operator

Let f(z) be of the form (2), then

$$D^o f(z) = f(z)$$

$$D'f(z) = Df(z) = zf'(z)$$

$$D^n f(z) = D(D^{n-1} f(z)) = z(D^{n-1} f(z))'$$

Hankel Determinant

Hankel Determinant is the determinant of a Hankel matrix. In 1976, Noonan and Thomas defined the $q - th$ Hankel Determinant. The elements of Hankel Determinant are the coefficients of functions in subclasses of S. The correct rate of growth of $H_q(n)$ for different subclasses of S is an open problem.

Let $f \in S$. Then the $q - th$ Hankel Determinant of f is defined for q ≥ 1 and n ≥ 1 by

$$\begin{bmatrix} a_n & a_{n+1} a_{n+2} & \cdots & a_{n+q+1} \\ a_{n+1} a_{n+2} & a_{n+3} \cdots & & a_{n+q} \\ a_{n+q-1} & a_{n+q} \cdots & & a_{n+2q-2} \end{bmatrix}$$

For q = 2 and n = 1, Fekete and Szego established the Hankel Determinant of f as

$H_2(1) = \begin{vmatrix} a_1 & a_2 \\ a_2 & a_3 \end{vmatrix} = a_1 a_3 - a_2^2$

The estimates of $|a_3 - \mu a_2^2|$ when $a_1 = 1$ with real $\mu \in \Re$ was studied by Fekete and Szego.

$$H_2(2) = a_2 a_4 - a_3^2$$

$$H_2(2) = a_3(a_2 a_4 - a_3^2) + a_4(a_2 a_3 - a_4) + a_5(a_3 - a_2^2)$$

The rate of growth of the Hankel Determinant $H_q(n)$ for $f \in S$ has been studied by many researchers.

Functions of complex order

A function $f(z) \in A$ is said to be starlike of complex order β if it satisfies the inequality

$$\Re\left(1 + \frac{1}{\beta}\left(\frac{z(f'(z))}{f(z)} - 1\right)\right) > 0, z \in U, \beta \in C\backslash\{0\}$$

Contribution to knowledge:

Vice-Chancellor sir, my University teaching experience cuts across State, Private and Federal Universities in Nigeria starting with Ladoke Akintola University of Technology, Ogbomoso, Nigeria in 1997. From there I crossed to the University of Ilorin, Nigeria in 2001. I was on one-year sabbatical placement at the Landmark University, Omu Aran, Nigeria in 2014.

Mr. Vice- Chancellor, Kindly permit me to discuss few of my contribution to knowledge.

Functional Analysis-Self Adjoint Operator Algebras

In the theory of continuous dimensions for subspaces affiliated with a type II_1 factors, Murray and von Neumann defined an invariant for its action on a Hilbert space. **Fadipe-Joseph** (2003, p.13) determined the possible values of the index for subfactors. The behaviour of the index under tensor products was studied. To supplement the theory of W*-algebra, many authors have shown the existence of the new factor of type II_1, by introducing a new property, called property P. **Fadipe-Joseph** (2003, p.58) showed that the extension property ties up with the injectivity of a von Neumann algebra. Similarly, **Fadipe – Joseph** (2004, p.1741) constructed the trace invariant for special angles by computing the trace invariant for some particular cases. It was established that the trace invariant can be used to determine the braid index in a great many cases.

Fadipe-Joseph, Tele and Makanjuola (2012, p.1) constructed the Kronecker Product of complex specialisation of the non-reduced Burau representation of the Braid group B_3. It turns out that, although the images are irreducible representations, the tensored mapping does not define a representation of B_3. **Fadipe-Joseph** (2006, p.387) obtained the Braid Index of knots with up to ten crossings. **Fadipe-Joseph**, Tele and Makanjuola (2013, p.271) reported that polynomial invariants can be used to calculate the braid index. The images of the 3-dimensional Burau representation at p^{th} root of unity of order 3 and 4 were used to obtain braid index.

Complex Analysis-Geometric Function Theory

Conditions for univalency of analytic functions in the unit disk were derived by Oladipo and **Fadipe-Joseph** (2004, p.1). The result contains sufficient conditions for starlikeness. Opoola, Babalola, **Fadipe-Joseph** and Rauf (2004, p.87) obtained some coefficient bounds of a subclass of univalent functions using Salagean differential operator. **Fadipe-Joseph** and Opoola (2005, p. 1872) provided the sufficient condition for a function to be starlike or convex. The relations between the norms of the pre-Schwarzian derivatives using subordination was provided. The norm estimates can be used to obtain growth and coefficient estimates for different classes of analytic functions. **Fadipe-Joseph** and Opoola (2007, p.374) applied subordination theory to establish some univalent functions properties. The upper bound for the Bloch-seminorm using the principle of subordination was given in **Fadipe-Joseph** and Opoola (2008, p.309). Coefficient inequalities were determined for univalent functions with negative coefficients that are convex of order alpha.

Opoola and **Fadipe-Joseph** (2009, p.57) investigated the Schwarzian derivative and univalent functions theory. The result obtained was applied in the univalency of some functions. **Fadipe-Joseph** and Opoola (2009, p.89) used subordination principle to establish conditions for starlikeness and convexity properties of univalent functions. The work was concluded by determining the radii of convexity and starlikeness of univalent functions with negative coefficients.

A new subclass of Salagean-type harmonic univalent functions was defined and investigated in Al-Shaqsi, Darus and **Fadipe-Joseph** (2010, p.1). Coefficient conditions, extreme points, distortion bounds, convolution and convex combination for the subclass of harmonic function were obtained. Ibrahim, Darus and **Fadipe-Joseph** (2010, p.75) established sufficient conditions for some subclasses of univalent functions using Salagean differential operator. There were different studies of univalent functions of fractional power.

P-Valent function

A function *f(z)* meromorphic in a domain is said to be p-valent in D (or multi-valent) if for each w_0(infinitely included) the equation $f(z) = w_0$ has at most p roots in D(where the roots are counted in accordance with their multiplicity) and there is w_1 such that the equation $f(z) = w_1$ has exactly p roots in D. **Fadipe-Joseph** and Opoola(2010,p.83) derived certain conditions for starlikeness and convexity for p-valent functions. One of the main results extends several results in the theory of analytic functions.

Functions whose derivative has a positive real part

Let R denote the class of functions which are regular and satisfy $Re\, f'(z) > 0$ for $|z| < 1$ and are normalised by $f(0) = 0$ and $f'(0) = 1$. If $|z| < 1$ and $f'(z)$ "$maps$ $|z| < 1$ upon a region contained within a half plane bounded by a straight line through the origin" then, $f(z)$ is Schlicht for $|z| < 1$. Let $p$be analytic in D, with $p(0) = 1$. For $0 \leq \alpha < 1$, denoted by P_α the class of functions P with Taylor series expansion $p(z) = 1 + \sum_{n=1}^{\infty} p_n z^n$ satisfying $Re\, p(z) > \alpha \quad (z \in D)$. Functions in P_0 which we denote by P, are referred to as functions with positive real part, or Caratheodory functions. Oladipo and **Fadipe-Joseph** (2012, p. 16) established the coefficient inequality for functions whose derivative has a positive real part. Olatunji, Oladipo and **Fadipe-Joseph** (2012, p. 191) studied partial sums of certain class of analytic and univalent functions by means of a more generalised Salagean operator. The lower bounds for these classes were determined.

Continued Fraction

In mathematics, a continued fraction is an expression obtained through an iterative process of representing a number as the sum of its integer part and the reciprocal of another number. Then, writing this other number as the sum of its integer part and another reciprocal and so on. Fraud is defined as any behavior by which one person intends to gain a dishonest advantage over another. In other words fraud is an act of commission which is intended to cause wrongful gain to one person and wrongful loss to the other, either by way of concealment of facts or otherwise.

Fraud has been the precipating factor in the distress of banks, and as much as various measures have been taken to minimize the incidence of fraud, it still rises by the day because fraudsters always device tactical ways of committing fraud. This has become a point of great attention in the banking sector. Fraud is one of the numerous enemies of the business world. The high incidence of fraud within the banking industry has become a problem to which solution must be provided in view of the large sums of money involved and its adverse implications on the economy. Fraud in its effects reduces the assets and increases the liability of any company. A lot of individuals and organisations yearly loose resources worth billions of naira to bank fraud which are perpetrated by bank staff. **Fadipe-Joseph** and Titiloye (2012, p.210) examined a finite continued fraction which is a finite expression obtained through an iterative process of representing a number. The use of continued fraction in controlling bank staff fraud was established. Oladele and **Fadipe-Joseph** (2014, p. 77)carried out a computational method of controlling bank staff fraud by using a data mining technique which is based on ledger assessment and job rotation. The technique of controlling bank staff fraud introduced in the work cannot be influenced by the bank management and the bank staff cannot predetermine when his ledger would be assessed or when his job would be rotated. **Fadipe-Joseph** and Adeniran (2019, p. 1) established the Continued Fraction for Patriarchal Practices in Nigeria.

Sigmoid function in Geometric Function Theory

Vice-Chancellor sir, **Fadipe-Joseph,** Oladipo and Ezeafulukwe (2013, p. 313) established the properties of sigmoid function in relation to univalent functions theory. It was established that the modified sigmoid function belongs to the class of Caratheodory function. This paper marks the beginning of applications of sigmoid function in GFT. Today, many researchers are using the article as the basis of their research in

GFT. **Fadipe-Joseph,** Oladipo and Ejieji (2013, p. 101) established sufficient conditions for a class of analytic and univalent functions of complex order. Subordination theorem and coefficient bounds for the class of functions defined were determined. Olatunji, Gbolagade, Anake and **Fadipe-Joseph** (2013, p. 43) investigated the coefficient bounds of the class Class T_n alpha beta in relation to the class of modified sigmoid function. Oladipo, **Fadipe-Joseph** and Ejieji (2013, p.341) determined the inequalities conditions for certain new classes of univalent functions. Also, the distortion inequalities for the new class of univalent functions were established.

Oladipo, **Fadipe-Joseph** and Moses (2014, p. 153) studied the new classes of uniformly w-starlike and w-convex functions using a generalised operator involving basic hypergeometric function. Precisely, properties such as coefficient bounds, growth and distortion theorems were considered. **Fadipe-Joseph,** Afolabi and Moses (2015, p. 31) used the principle of subordination to define new subclass of bi-univalent functions. The bounds of the coefficients of functions in these classes were obtained. Furthermore, Fekete-Szego functionals for the new classes involving sigmoid functions were given.

Harmonic Univalent Function

A continuous function $f = u+iv$, defined in a subset D of the complex plane is harmonic in D if both u and v are real and harmonic in D. In a simply connected subdomain of D, we can write $f=h+\bar{g}$where both f *and* g are analytic, and $\bar{g}$ is the complex conjugate of g. h is the analytic part and $\bar{g}$ is the co-analytic part. However, **Fadipe-Joseph,** Afolabi and Moses (2015, p.85) introduced a new class of harmonic univalent function using the modified Salagean differential operator. Distortion bounds, convolution and convex combination in the new class were obtained. **Fadipe-Joseph**, Moses and Opoola (2015, p. 95) established the p-valence of the generalised Bessel function of the first kind. Moses, **Fadipe-Joseph** and Opoola (2016, p.90) established the starlikeness, convexity of order alpha and type beta for the class of p-valent Bessel function. Furthermore, the coefficient inequalities, radius of starlikeness and radius of convexity for the class were obtained.

Fadipe-Joseph, Moses and Oluwayemi (2016, p. 83)used an operator involving the modified sigmoid function introduced in the presentation book, International Congress of Women Mathematicians, Seoul, Korea in 2014 to develop a new family of analytic function. Coefficient inequalities, growth and distortion theorems for this class were provided. Oladipo and **Fadipe-Joseph** (2016, p.1) studied some Iterated Integral transforms of modified sigmoid function (logistic type) in relation to the Caratheodory family. Makinde and **Fadipe-Joseph** (2016, p. 21) investigated some properties of univalent functions with missing coefficients of alternating type. **Fadipe-Joseph,** Adeniran, Kadir and Adeniran (2017, p.50) obtained the Coefficient Bounds for the functions in the class of sigmoid function. The work was concluded by determining the Fekete-Szego Functional and Hankel Determinant.

Oluwayemi and **Fadipe-Joseph** (2017, p.187) investigated a subclass of analytic function in the open unit disk. Using Ruscheweyh operator, a generalised Salagean differential operator involving modified sigmoid function was established. The results obtained generalised some earlier results.

Biharmonic function

A continuous complex valued function $F = u + iv$ in a domain$D \subseteq \mathbb{C}$ is biharmonic if the Laplacian of *F* is harmonic in *D*. *F* satisfies the biharmonic equation $\triangle(\triangle F) = 0$, where $\triangle = 4\frac{\delta^2}{\delta z \delta \bar{z}}$. Consequently, **Fadipe-Joseph** and Salami (2017, p. 1) established properties of a new class of Biharmonic Univalent function using the modified Salagean differential operator. The work generalised some earlier results. **Fadipe-Joseph**, Ademosu and Murugusundaramoorthy (2018, p.59) defined a new subclass of univalent function based on Salagean differential operator and obtained the coefficients using the techniques of Briot-Bouquet differential subordination in association with the modified sigmoid function. Furthermore, the classical Fekete-Szego inequality result was given. Murugusundaramoorthy, Olatunji and **Fadipe-Joseph** (2018, p. 55) defined new subclasses of analytic functions in the space of logistic sigmoid functions based on quasi-subordination. The results for the associated classes involving subordination and majorization were discussed. Ezeafulukwe, Darusand **Fadipe-Joseph**(2018, p.171) used certain properties of a sigmoid function and determined the starlikeness and convexity of this function.

The Chebychev Polynomial

Vice-Chancellor sir, the Chebyshev's polynomial are two sequences of polynomials related to the cosine and sine functions notated as $T_n(x)$ and $U_n(x)$. They are sequences of orthogonal polynomials which are related to De'Moivres formula and are defined recursively. There are four kinds of Chebychev polynomials. The majority of books and research papers dealing with specific orthogonal polynomial of the Chebychev family contain mainly results of the Chebychev polynomial of first and second kinds $T_n(t)$ and $U_n(t)$ and their numerous uses in different applications. The Chebychev polynomials of the first and second kind are defined as:

$$T_n(t) = \cos n\alpha \qquad t \in (-1, 1)$$

$$U_n(t) = \frac{\sin(n+1)\alpha}{sin\alpha} \qquad t \in (-1, 1)$$

where n denotes the degree of the polynomial and $t = \cos\alpha$. Therefore, **Fadipe-Joseph,** Kadir, Akinwunmi and Adeniran (2018, p.88) defined a new subclass of univalent function using the Salagean differential operator involving the modified sigmoid function and the Chebyschev polynomials. The results obtained agree and extend some earlier ones. **Fadipe-Joseph**, Adeniran and Windare (2018, p.39) established new subclasses of univalent function involving the modified sigmoid function using subordination principle. The initial coefficient bounds and Fekete-Szego functional were obtained. **Fadipe-Joseph,** Moses and Opoola (2018, p.107) determined the Fekete-Szego inequality with sigmoid function for certain subclasses of multivalent Bessel functions. Afolabi, **Fadipe-Joseph,** Ejieji and Oluwaseyi (2019, p.36) used a generalised linear multiplier fractional differential operator to define a new family of harmonic univalent functions in the unit disk. The coefficient conditions, convolution and convex combination for the class were obtained.

In complex analysis, a punctured disc is a disk in the complex plane with a single point removed from its centre. Consequently, **Fadipe-Joseph** and Dada (2019, p.473) examined a Class of p-valent functions in the punctured disc. The result was motivated by Aouf differential operator. By making use of a generalised Salagean differential operator involving modified real sigmoid function, various geometric properties were examined by Oluwayemi, **Fadipe-Joseph** and Ezeafulukwe (2019, p.1742). **Fadipe-Joseph**, Opaleye and Oluwaseyi (2019, p.1) established a new class of analytic function defined by q-derivative of modified Tremblay fractional derivative operator in the unit disk. The results obtained generalised some earlier ones in literature. Olatunji and **Fadipe-Joseph** (2019**,** p.227) investigated the initial Chebyshev polynomial class of analytic functions based on quasi- subordination. The coefficient estimates including the relevant connection to the Fekete-Szego inequality of functions were derived. Also, certain results for the associated classes involving subordination and majorization were presented. **Fadipe-Joseph**, Oluwaseyi and Opaleye (2020) defined a new class of functions over the quaternions. The initial coefficient bounds for the class defined were obtained. The work was concluded by establishing the Fekete-Szego˙ functional. **Fadipe-Joseph**, Windare and Adeniran (2020, p. 454) obtained the coefficient bounds for a class of univalent functions involving the modified sigmoid function. Some consequences of the results obtained were established. **Fadipe-Joseph,** Aina and Titiloye (2020, p.1) gave two classes of analytic functions. Coefficient estimates of the given classes of univalent functions using subordination principle were obtained.

Q-sigmoid function

Vice-Chancellor sir, recently, a modified q-sigmoid function was defined and the Fekete-Szego functional for certain normalised analytic function defined on the open unit disk was given in Ezeafulukwe, Darus and **Fadipe-Joseph** (2020, p.621). As an application of the main result, the initial coefficients and Fekete-Szego inequality for subclasses of starlike functions related to sigmoid function were pointed out. The q-analogue of sigmoid function in the space of univalent lambda-pseudo starlike functions was derived. Ezeafulukwe, Darus and **Fadipe-Joseph** (2021**,** p.311) obtained certain properties of a sigmoid function and determined the starlikeness and the convexity of this function. **Fadipe-Joseph**, Windare, Adeniran and Olatunji (2021, p.387) investigated the remodelled sigmoid function in the mirror of univalent functions using the well-known differential operator. The growth and distortion theorems were obtained. Also, application of fractional calculus to this class of functions was established.

Fadipe-Joseph and Oluwayemi (2021, p.515) established certain class C_α and its coefficient bounds. Moreover, initial coefficients of the class C_α related to sigmoid functions and its Fekete-Szego functional were obtained. An upper bound for the second Hankel determinant |H2(1)| for the class defined was established. Oluwayemi, **Fadipe-Joseph** and Najafzadeh (2021, p.2807) established a new family of analytic functions involving sigmoid function defined as $T\gamma(\lambda, \beta, \alpha, \mu, cm) \subset T\gamma(\lambda, \beta, \alpha, \mu)$. Certain geometric properties of the class were obtained. **Fadipe-Joseph**, Oluwayemi and Titiloye (2021, p.73) obtained some geometric results on certain new classes of analytic functions involving sigmoid function defined by **Fadipe-Joseph**, Moses and Oluwayemi (2016, p.83). Extreme point property, radius of starlikeness and convexity, convolution property and Fekete-Szego inequality for the class were proved.

Fadipe-Joseph, Olawumi, Ezeafulukwe, Ejieji and Titiloye (2021, p.19) defined two classes of multivalent functions. The initial coefficient bounds for the subclasses of multivalent functions involving modified q-sigmoid function were investigated. The work was concluded by establishing the Fekete-Szeg¨o functional and Hankel determinant for the classes of functions defined. The results generalised some earlier ones in literature. **Fadipe-Joseph** and Olawumi (2022, p.1) obtained the initial coefficient bounds for a class $M_q^{\lambda}(\gamma,\ t,\ b)$ of an analytic function involving modified q-sigmoid associated with quasi-subordination. The Fekete-Szeg*o* functional and Hankel determinant for the class were investigated.

Oluwayemi and **Fadipe-Joseph** (2022, p.1) introduced a generalised multiplier operator and used it as a tool to define and investigate a new class of function. Various properties of the class of functions defined were investigated. The results extend some known results in literature. This article, 'A New Class of Function with Finitely Many Fixed Points', has been recognised as Article of the Year 2022 by Abstract and Applied Analysis. A congratulatory message and certificate of award was sent from the Chief Editor on August 1, 2023:

"Dear Dr. Fadipe-Joseph,

I am delighted to let you know that your article, 'A New Class of Function with Finitely Many Fixed Points', has been selected by the Chief Editor, Dr. Patricia J. Y. Wong, as the winner of the **Article of the Year Award 2022** for ***Abstract and Applied Analysis***.

The Article of the Year Award recognizes original research and review articles published in Hindawi journals that our Chief Editors consider impactful and representative of their journal's research community and its current or future directions.

We are proud to celebrate our authors as we take steps to uphold research integrity as a publisher, and highlight the valuable research contributions to the scientific community that are an honest reflection of the science.

Congratulations from the Chief Editor

Dr. Patricia J. Y. Wong believes your article represents a valuable contribution to *Abstract and Applied Analysis* from 2022. They selected your article for the following reason(s):

"In this article, a generalised multiplier operator is defined and used to define a class of univalent function. Geometric properties of the class and its subclass have been investigated. The results obtained are significant, and the generalisation of many known results in the literature."

Recognising and rewarding your achievement

You can find your publication on the **Article of the Year 2022 webpage**. We will soon be promoting your achievement on the *Abstract and Applied Analysis* homepage and Hindawi's social media channels. You can also download a certificate acknowledging your award."

Oluwayemi and **Fadipe-Joseph** (2023) established that Chebyshev polynomial of the second kind belongs to the class of functions with positive real part. The convolution of the Chebyshev polynomial and modified sigmoid function was obtained. The convolution gives a function which belongs to the class of functions with positive real part. Furthermore, subordination principle was used to determine new classes of functions. The coefficient bounds for the new classes of functions defined in the work were obtained.

Coefficient problems

Theorem 5: Let $\phi(z)$ be a sigmoid function and $\psi(z) = 2\phi(z)$ then $\psi(z) \epsilon P, |z| < 1$

Theorem 6: Let $\phi(z) = \frac{1}{1+e^{-z}}$, then ϕ is of bounded turning.

Theorem 7: Let

$$\Psi_{n,m}(z) = 1 + \left(\sum_{m=1}^{\infty} \frac{(-1)^m}{2^m} \left[\sum_{n=1}^{\infty} \frac{(-1)^n}{n!} z^n \right]^m \right)$$

then

$$\Psi_{n,m}(z) < 2$$

Recent Advances: q - sigmoid function

For any fixed real number $q > 0$, non-negative integer r, the $q -$ integers of the number r is defined by

$$[r]_q = \begin{cases} \frac{1-q^r}{1-q}, & q \neq 1 \\ r, & q = 1 \\ 0, & r = 0 \end{cases}$$

The q - fractional is defined in the following:

$$[r]_q! = \begin{cases} [r]_q [r-1]_q \cdots [1]_q \\ 1, & r = 0 \end{cases}$$

A q-analogue of exponential function $e^z = \sum_{k=0}^{\infty} \frac{z^k}{k!}$ is defined by $e_q{}^z = \sum_{k=0}^{\infty} \frac{z^k}{[k!]_q}$

A q-Sigmoid function is defined as $g_q(z) = \frac{1}{1+e_q^{-z}}$

Ezeafulukwe, Darus, Fadipe-Joseph (2020, p.621) defined a modified q-sigmoid as

$$\Psi_{q,m,k}(z) = 1 + \left(\sum_{m=1}^{\infty} \frac{(-1)^m}{2^m} \left[\sum_{k=1}^{\infty} \frac{(-1)^k}{[k!]_q} z^k \right]^m \right)$$

The initial coefficients and Fekete-Szeg$\hat{o}$ inequality for a subclass of starlike function related to q-sigmoid function were obtained.

Summary

Before 2013 researchers in GFT use a normalised function of the form:

$$f(z) = z + \sum_{n=2}^{\infty} a_n z^n$$

Today, with the introduction of a modified sigmoid function,

$$\psi(\mathrm{z}) = \frac{2}{1+e^{-z}}$$

an activation function, many results which generalise the earlier ones and new results can be obtained.

Therefore,

$$f(z) = z + \sum_{n=2}^{\infty} \psi(z) a_n z^n$$

The findings in the research work conclude that the sigmoid function can be used in geometric function theory. The results find applications in many fields of mathematical sciences.

My Contribution to the Academic Communities

Vice-Chancellor sir, I have served this University at various levels:

Departmental Level:

- Level Adviser;
- Taught undergraduate and postgraduate courses;
- Book donation to the Department of Mathematics, University of Ilorin, Ilorin by the Abdus Salam International Centre for Theoretical Physics (ICTP), Italy (2015 - 2017) during the period of my associateship at ICTP;
- The Department of Mathematics received a letter of commendation from the postgraduate school during my tenure as the Departmental Postgraduate Coordinator. The

letter which was dated 9th January 2019 reads "The Board of Postgraduate School as its 274th meeting held on 19th December, 2018 observed the timely processing of the results of Doctoral Research Protocol and Master Results. You are hereby commended for this excellent turn out"; and

- I have successfully supervised 18 students for Masters in Mathematics. Also, 3 students have completed their PhD under my supervision and 5 PhD students are undergoing their research works.

Faculty Level:

- Chairperson, Faculty of Science, Web Committee 2018;
- Chairperson, Petroleum Technology Development Fund, (PTDF) Web-Ring Committee, 2017;
- Chairperson, Dress Code Committee (2016-2018);
- Organiser, Google Apps training for academic staff (Faculty of Science), Dec.20-21, 2016;
- Member, Ethical Review Committee, 2013;
- Chairperson, Faculty of Science Environmental Committee, 2013;
- Member, Certificate Screening sub-committee, 2013;
- Member, Examination Malpractices Committee, 2012;
- Member, Committee on Courseware, 2011;
- Member, Environmental Sanitation Committee, 2008; and
- Member, Web-Ring Sub-Committee, 2007.

University Level:

- Member, Admissions Technical Committee;
- Internal Examiner from related Departments;
- Member, Adhoc Committee on proposal of action between University of Massachusetts Lowell (UML, USA) and University of Ilorin, 18th October, 2011;
- Member, Convocation and Ceremonials Committee (2009 - 2012).

Vice- Chancellor sir, I was appointed as the first Deputy Director (Academic), Centre for Open and Distance Learning (CODL), University of Ilorin by Prof. Sulyman Age

Abdulkareem. The Centre was able to receive her license during my tenure. Also, I coordinated the writing of the Instructional materials in Mathematics for CODL.

Contribution to the Mathematics Community at the International Level

Vice- Chancellor sir, I have attended and presented my research findings in workshops and conferences at the national and international levels. I was appointed by the African Mathematical Union in 2022 to Chair the Commission for African Women in Mathematics. The Commission for African Women in Mathematics, AMU-CAWM, is one of the Commissions of African Mathematical Union. My obligation is to coordinate the activities of the African Women in Mathematics for the period 2022-2026. I was a Curriculum Reviewer-Mathematics Programme for Pan African University Institute for Basic Sciences, Technology and Innovation, Nairobi, Kenya, 2023. I am a reviewer of many reputable academic journals. Also, I am the only Ambassador for Nigeria, International Mathematical Union (IMU), Committee for Women in Mathematics (2016-date).

Contribution to the Mathematics Community at the National Level

Mr. Vice-Chancellor,

- I was a Facilitator, National Mathematical Centre, Abuja Foundation Postgraduate Course on Complex Analysis, 2022. Researchers were taken through basic theorems in Complex Analysis.
- I am an External Examiner in Nigerian Universities;
- Member of Council, Nigerian Mathematical Society (NMS) (2019-date);
- Member of Council, Nigerian Women in Mathematics (NWM) ;
- Delegate and Jury member for The National Mathematics Competition for the University Students (NAMCUS) held at National Mathematical Centre, Abuja, Nigeria, 2008, 2011-2014;

- Secretary, Local Organising Committee for the Nigerian Mathematical Society Conference, 2009 which was hosted by the Department of Mathematics, University of Ilorin;
- Resource person, African Mathematical School organised by Centre International de Mathématiques Pures et Appliquées (CIMPA), France/African Mathematical Union (AMU) held (August 1 – 13, 2016) at Landmark University, Omu-Aran; and
- Resource person, Algebra, Topology and Applications Workshop, Department of Mathematics, University of Ibadan, July 3-7, 2023.

Community Service

Presently, I am the Kwara State Coordinator, Teenagers Outreach Ministry (TOM), a ministry which reaches the teenagers all over the world with the gospel of the Lord Jesus Christ. I give Endowment fund: **Fadipe-Joseph** Prize in Mathematics for the best female student in Junior Secondary Schools in Ilorin.

Vice-Chancellor sir, I was elected unopposed as the President, Unilorin Scientific Multipurpose Cooperative Society (USMCS) in 2019.

(Please listen to, and be part of the brief video clip which is on the Second World Meeting of Women in Mathematics, held virtually on July 1-2, 2022 as a special satellite event of the International Congress of Mathematicians).

Challenges met by African Girls who Love Mathematics and how to Improve the Situation

There are girls in Africa who love Mathematics but there are different challenges. The belief of the society is that Mathematics is for men. This has affected the study of Mathematics in Africa. All over the world and especially in Africa, women in Mathematics are very few. Women and girls in Mathematics are faced with gender-based violence and social stigma. If we will see further, we must stand on the shoulders of those who have gone ahead of us. That is why the place of mentoring cannot be over emphasised. Knowledge is continuous and cumulative. It is only by learning from great minds that one can contribute meaningfully and become an icon, a reputable and dignify personality tomorrow.

Are there Challenges for Girls in Mathematics?

YES!

Lack of mentors/mentoring/a guide in the right direction and lack of self esteem. Lack of confidence, lack of encouragement, environmental/societal factors (and these varies), family exposure, poverty, inconsistency in academic calendar, reluctance in giving females positions, high level of disparity in levels of gender diversity in top management positions and funding among others. These challenges need to be addressed to attract and support girls who love mathematics. There are programmes for girls to convey the love of mathematics and the messages that mathematics is everywhere and that it is useful.

Children can be engaged in arithmetic at the elementary level, Mathematics clubs, quiz competitions and talks could be organized more frequently in schools. These will give girls opportunities to build their confidence in Mathematics. Government, parents and teachers should provide a conducive environment for girls. Marriage is cherished in Africa. Women are faced with the challenges of combining work and family responsibilities. Therefore, many women engage in small scale trading which has a lower earning. Inequality is more pronounced in paid-employment than in self-employment. There are few women in Mathematics with higher level of education.

Regular talk on how to choose a mentor and how to balance career and family are necessary. With determination women can manage career, work and family life by proper planning of time. Women should be encouraged to attend conferences and workshops that will enhance their career. There should be age benefit for women with children when applying for any support. This will also give women the opportunity of interacting with other women in Mathematics. Awards to the best female students in Mathematics can be given to encourage girls. Mentors should assist and inform mentees on research opportunities. Finally, an African girl who wants to have a career in Mathematics should not allow any discouragement. She can have at least a mentor in the same field of Mathematics. Also, she should choose a spouse who will support her career.

Conclusion

Mr. Vice-Chancellor, distinguished ladies and gentlemen, my contribution to knowledge in Mathematics most especially GFT made me conclude that whether black or white, male or female, **Mathematics is for All**. I have done nothing less than what a man can do in the world of Mathematics and research still continues. Despite the stigma that Mathematics is not for women, it is for strong men, today I can strongly say that Mathematics is for All. My journey in life as an African female mathematician which was summarised in this lecture must have convinced all that Mathematics is for All.

Acknowledgements

I thank God who put me on the right path of career in life. He made my dream of becoming a Professor of Mathematics come to pass. I cannot thank Him enough for the sustenance in the journey of Mathematics. *To God alone be the glory.*

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Mr. Vice-Chancellor, permit me to conclude the inaugural lecture with this song by Gbenga Akinfenwa:

Ki ma ma ise tori mo dara	It's neither that I'm good looking
Tabi tori mo mo aduraa gba oo	not because I know how to pray
Anu (Yea eh eh)	but for mercy,
Anu (Anu ni oo)	I have received mercy.
Anu ni mori gba eh	
Ki ma ma ise ile ti mo wa	It's neither for where I live
Tabi tori gbogbo iwe ti mo ka eh eh	nor for my academic achievements
Anu (Anu Oluwa o)	but for mercy,
Anu (To gbemi roo yeah eh)	I have received mercy.
Anu ni mori gba eh	
Moni ki ma ma ise tori	I am at peace not of the work of any
moni baba Isale.	human god father but for mercy.
lo mu kokan mi fi bale	I have received mercy
Anu (Anu iyi o)	
Anu (Anu Oluwa o)	
Anu eh eh ni mori gba eh	

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