Walter Sisulu University

PROFESSORIAL INAUGURAL LECTURE

21 July 2010

Reflections of a Mathematician

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Auditorium, Nelson Mandela Drive Campus, Mthatha, Eastern Cape

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WALTER SISULU UNIVERSITY
PROFESSOR OF MATHEMATICS
DIRECTOR OF SCHOOL OF MATHEMATICAL AND COMPUTATIONAL SCIENCES
FACULTY OF SCIENCES, ENGINEERING AND TECHNOLOGY

TOPIC

REFLECTIONS OF A MATHEMATICIAN

BY
SN MISHRA

DATE: 21 JULY 2010

VENUE: WSU AUDITORIUM

The Vice Chancellor,
Deputy Vice Chancellor: Academic Affairs and Research,
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Executive Deans of Faculties,
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Heads of Departments,
Students,
Members of the University Community and Colleagues,
Distinguished Guests,
Friends,
Ladies and Gentlemen

It is my pleasure to stand before you to give this inaugural lecture on behalf of the Department of Mathematics in the School of Mathematical & Computational Sciences. I am humbled by your presence this afternoon.

1. Introduction

Having a long academic career spanning almost 33 years after my doctoral work, I was at a loss when choosing a topic that would be appropriate for my inaugural lecture. I have a great passion for the history of science as well as for teaching, apart from my own research. In addition, the diversity of the audience (young and old) and sensitivity to the environment in which we live may be considered other contributing factors. It is said that old is gold and old people live in the past while younger ones are interested in future. After a balancing act, I found the current topic of “Reflections of a Mathematician” quite accommodating.

I did my doctoral studies at the University of Allahabad, under the guidance of the late Professor Pramila Srivatava. The University had a strong school in *Fourier Analysis* and *Summability Theory* apart from *Astronomy* and *Astrophysics*. These diverse fields had a strong impact on my own training in the field of *Nonlinear Functional Analysis (specifically, the study of invariant or fixed points)*, the broad area of my research. Therefore, the current topic will inevitably be influenced by the above factors.

Irrespective of the time, age and the environment in which we live in, certain things remain invariants. Therefore, a large part of my presentation this afternoon may centre about some of these invariants, whose origin may be traced back as early as the 18th century, which continue to impact heavily on the current scientific research.

In this lecture, an attempt is made to convey in a broad sense about mathematics and its applications and the impact it has made outside its own domain. While doing so, we try to dispel the belief (held in certain quarters) that there are two types of mathematics, namely useful mathematics and not so useful mathematics. An attempt is also made to reflect on the role of mathematics in industry along with the challenges of teaching of mathematics in the current environment.

2. Invariant points or fixed points

Let us introduce some mathematical language. Suppose we have two sets, X and Y, of variables (which we prefer to call points). By a transformation or function from X to Y, we mean a relationship between the variables coming from these two sets, which satisfy certain rules. In the language of dynamical systems, any transformation may simply be considered as a movement. Usually, any sets X (respect. Y) Is endowed with some kind of structure and the set X (respect. Y) together with this structure is referred to as a space X. Thus a point p of the space X is called an invariant point (or a fixed point) under a transformation T if it does not move (that is, $T(p) = p$). By a continuous transformation, we shall mean that its graph can be drawn on a sheet of paper without lifting the pencil, or in case of a computer, it may give an "error" message.

One of the earliest results in the study of fixed points may be traced back to a simple but very powerful result of the Dutch mathematician L. J. Brouwer [Math. Ann. 71, 97-115] in 1912 that states that every continuous transformation of the unit interval [0,1] (that piece of the real number line which runs from zero to one, the end points included) has a fixed point. This marks the beginning of what is known as the topological fixed point theory. In the hands of an economist, Brouwer's theorem can be helpful to calculate a certain economical equilibrium. For example, one can come to conclusions like "supply and demand meet each other exactly on a particular equilibrium point".

Another powerful result was obtained by the Polish mathematician S. Banach [Fund. Math. 3, 133-181] in 1922. It states that every transformation T which contracts distances between any pair of variables of a space X and the pair of their mages in the same space, where X is complete in some sense, has a unique fixed point. This line of research, which is well known for its constructive way of proof and its tremendous applications, is now called the metric fixed point theory.

My own research has been concerned mainly with the study of fixed points (construction, location, approximation and applications) of contractive and non-expansive classes of mappings in different settings including uniform spaces (and locally convex spaces) and their applications to probabilistic analysis, random fixed point theory and fuzzy systems. As far as the methods/tools/techniques used are concerned, they came mainly from non-linear analysis and general topology (including the classical methods, such as, dimension theory). The results obtained present a variety both in theory as well as in applications. Some of the recent results obtained by our team with national and international collaboration may be considered very significant in the sense that they have removed/rectified various mistakes in existing literature, which have been there for almost 20 years. In another case (characterization of finitistic spaces) a solution of the famous Alexandrov problem (which was already settled earlier in the negative) on cohomological dimension has been revisited and a far superior characterization of finitistic spaces has been obtained. For specifics and critical details of these results, one may refer to my list of publications attached under appendix.

Earlier, I have talked about the word "Old" which I would like to specify now in the present context. In The *Vedic Tradition*, there is a message or a guiding principle that says:

"Mahajano yen gatah sa pantha"

which translates into English to:

"Follow the path that has been used by great people"

Therefore, by "*Old*" here we mean our great ancestors in science. Thus in the following sections, I shall talk about some of these persons and their work.

3. The Nobels of mathematics

In the past several years, economic science has developed increasingly in the direction of a mathematical specification and statistical quantification of economic contexts. Scientific analysis along these lines is used to explain such complicated economic processes as economic growth, cyclical fluctuations, and reallocations of economic resources for different purposes.

Economics is one of the areas for which a Nobel Prize is awarded. However, the subject of mathematics, unlike other areas of science, does not qualify for a Nobel Prize. Interestingly, a number of mathematicians have earned this prize for their work in economics and literature. By the Nobels of mathematics, we simply refer to these mathematicians.

3.1 Jan Tinbergen and Ragner Frish

In economic life, there is an elusive mixture of relatively systematic interrelations, for which one can find a more or less regular repetitive pattern and historically unique events and disruptions. To the layman, it may seem somewhat reckless to seek, without support from experiment, for laws of development within these extremely complicated processes of economic change, and to apply for this purpose the techniques of mathematical and statistical analysis. However, the attempts of economists to construct mathematical models relating to strategic economic relations, and then to specify these quantitatively with the help of statistical analysis of time series, have, in fact, proved successful. It was precisely this line of economic research, mathematical economics and econometrics, that has characterized the development of this discipline in recent decades. It was therefore only natural that the Nobel Prize in economics in 1969 was awarded to the two pioneers in this field of research, Ragnar Frisch of Norway(Economist) and Jan Tinbergen mathematician/physicist) of Holland.

3.2 L. Kantorovich and T. A. Koopmans

The basic economic problems are the same in all societies, regardless of whether these are characterized by capitalism, socialism or other types of political organization. As the supply of productive resources is limited, everywhere, all societies are confronted by a series of questions concerning the optimal use of available resources and the fair distribution of income among citizens. Such normative questions can be treated in a scientific manner that is independent of the political order. At the end of the 1930's L. Kantorovich (of Russia) was faced by a concrete planning problem - how to combine the available productive resources in factory in such a way that production was maximized. He solved this problem by inventing a new type of analysis, later called linear programming. This is a technique for finding the maximum value of a linear function under constraints consisting of linear inequalities. A characteristic feature of this technique is that the calculations give as by-products some expressions, called shadow prices, which possess certain qualities that make them useful as accounting prices. During the following two decades, Kantorovich developed his analysis further, and applied it to macroeconomic problems. For his monumental work, he was awarded a Nobel Prize in Economics in 1975 that he shared with T. Koopmans (of USA).

3.3 Brouwer's descendants

Whereas mathematical probability theory ensued from the study of pure gambling without strategic interaction, games such as chess, cards, etc. became the basis of game theory. The latter are characterized by strategic interaction in the sense that the players are individuals who think rationally.

A generalization of Brouwer's result by Kakutani in 1941 [Duke Math. J. 8, 457-459] along with earlier investigations by von Neumann (and others) lead to the study of mathematical formulations of games. It was not until the economist Oskar Morgenstern met the mathematician John von Neumann in 1939 that a plan originated to develop game theory so that it could be used in economic analysis. The foundations for using game theory in economics were introduced in a monumental study by von Neumann and Morgenstern in the "Theory of Games and Economic behavior" in 1944. Subsequently, game theory became a dominant tool for analyzing economic issues. In particular, non-cooperative game theory, i.e., the branch of game theory, which excludes binding agreements, has had great impact on research in economics. The principal aspect of this theory is the concept of equilibrium, which is used to make predictions about the outcome of strategic interaction. John F. Nash Jr. (mathematician), Reinhard Selten (Economist) and John C. Harsanyi (Economist) are three researchers who have made eminent contributions to this type of equilibrium analysis and shared the Nobel Prize in Economics for the year 1994.

3.4 Betrand Russel

Over a long and varied career, Bertrand Russell (1872-1970) made groundbreaking contributions to the foundations of mathematics and to the development of contemporary formal logic, as well as to analytic philosophy. His contributions relating to mathematics include his discovery of Russell's paradox, his defence of logicism (the view that mathematics is, in some significant sense, reducible to formal logic), his introduction of the theory of types, and his refining and popularizing of the first-order predicate calculus. Along with Kurt Godel, he is usually credited with being one of the two most important logicians of the twentieth century. Russell discovered the paradox, which bears his name in May 1901, while working on his *Principles of Mathematics* (1903). He was awarded a Nobel Prize in literature in 1950.

Mathematics-Pure & Applied

There is a general perception that there are two types of mathematics, namely, useful mathematics and not useful mathematics. And, all useful mathematics is taught in applied mathematics whereas the mathematics that is taught in pure mathematics is useless. Nothing could be further from truth. In this section, I shall present some examples from the history of mathematics where a "pure concept" has given birth to so many applications while an "application related problem" has lead to various concepts of pure mathematics.

3.5 Joseph Fourier

Joseph Fourier's work (1768-1830) on the subject of heat propagation, heat radiation and heat conservation is considered as one of the finest pieces in applied mathematics (mathematical physics). It was the success of Fourier's work in applications that made necessary a redefinition of the concept of function, the introduction of a definition of convergence, a re-examination of the concept of integral, and the ideas of uniform continuity and uniform convergence. Fourier's work also provided motivation for the discovery of the theory of sets, was in the background of ideas leading to measure theory, and contained the germ of the theory of distributions. All these areas, considered as a part of pure mathematics, have themselves found nice applications in the present daytime.

3.6 Srinivas Ramanujan

Number theory, in particular, S. Ramanujan's work (1887-1920) promises not only to enrich pure mathematics but also to find applications in various fields of mathematical physics. Rodney J. Baxter of the Australian National University, for example, acknowledges that Ramanujan's findings helped him to solve such problems in statistical mechanics as the so-called hard hexagon model, which considers the behavior of a system of interacting particles laid out on a honeycomb-like grid. Similarly, Carlos J. Moreno of the City University of New York says that Ramanujan's work in number theory known as modular forms is exactly what physicists need when they work on the 26-dimensional mathematical models in super-string theory. More and more often, mathematicians (and computer scientists) are finding that their clever new ideas were first discovered by Ramanujan. In fact, William Gosper of Symbolics Inc., Palo Alto, California, called Ramanujan as Nemesis.

He asks:

"How can we love this man if he is forever reaching out from the grave and snatching out our neatest results?"

Gosper has recently devised a new computer algorithm to calculate the number "Pi" to 17.5 million digits. However, repeatedly, he found that his best ideas *were already discovered by Ramanujan. He writes that:*

"If Ramanujan were still alive, what I would do is show him my computer and hope to seduce and distract him."

The great Number Theorist, Professor Bruce C. Burndt at the University of Illinois has spent 12 years of his life in simply decoding (and expanding) what is called *Ramanujan's Lost Note Books.*

4. Fractal geometry and Mandela shirt

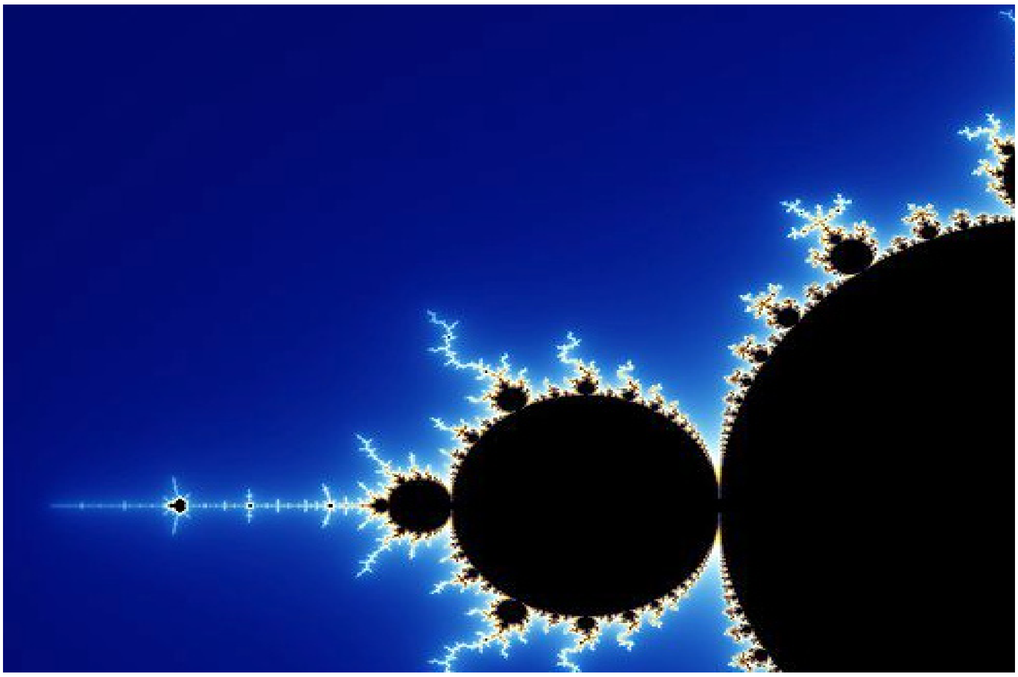
A fractal is "a rough or fragmented geometric shape that can be split into parts, each of which is (at least approximately) a reduced-size copy of the whole, a property called self similarity". Roots of mathematically rigorous treatment of fractals can be traced back to the study of certain functions by Karl Weierstrass, George Cantor and Felix Hausdorff. However, the term fractal is due to the Polish mathematician Benoit

Mandelbrot who introduced it in 1975. A mathematical fractal is based on an equation that undergoes interation, a form of feedback based on recursion.

This is an important area in which the metric fixed point theory plays an important role. It is also my new interest of research.

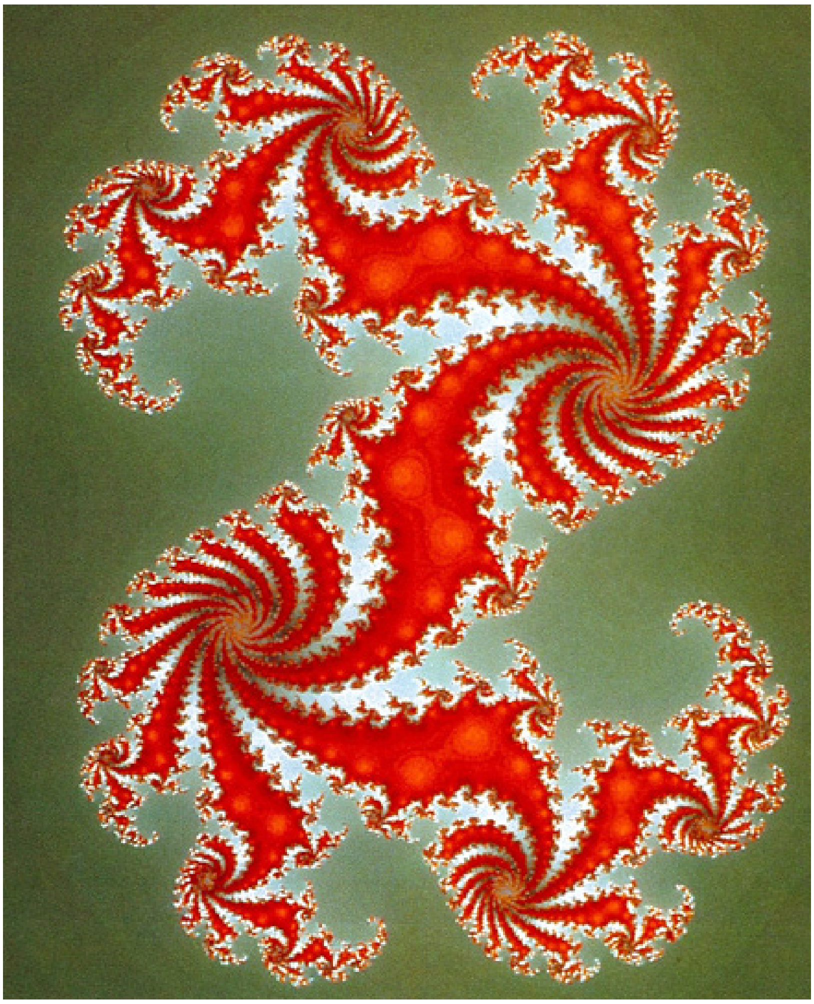
The School of Mathematical and Computational Sciences is currently running a research project on *Iterative Modelling of Chaos and Fractals* in colloboration with Prof. S.L Singh from India who visited the school in 2009 and is scheduled for a visit this year. This project is supported by the Directorate of Research Development. Dr W. Sinkala from the department of applied mathematics is also a valuable member of our research group.

To give a flavour of fractals in mathematics, let z_0 be an arbitrary element of C, the complex plane. We construct a sequence $\{z_n\}$ of points of C using the well-known Picard iteration in the following manner: $z_n = f(z_{n-1}) \quad n = 1,2,...$ for some complex-valued function f. The sequence $\{z_n\}$ constructed this way is called the orbit of z_0 under f. Many fractal sets can be generated using the function $f(z) = z^n + c$. For example the set of complex values of c for which the orbit remains bounded is called the *Mandelbrot set*.



Mandelbrot set

Another famous set, the Julia set - named after the French mathematician Gaston Julia (1893-1978) - iterates the same function, but for fixed c and varying z values. The set of complex values of z_0 for which the orbit of z_0 under iteration of the complex quadratic polynomial remains bounded is called the Julia set.



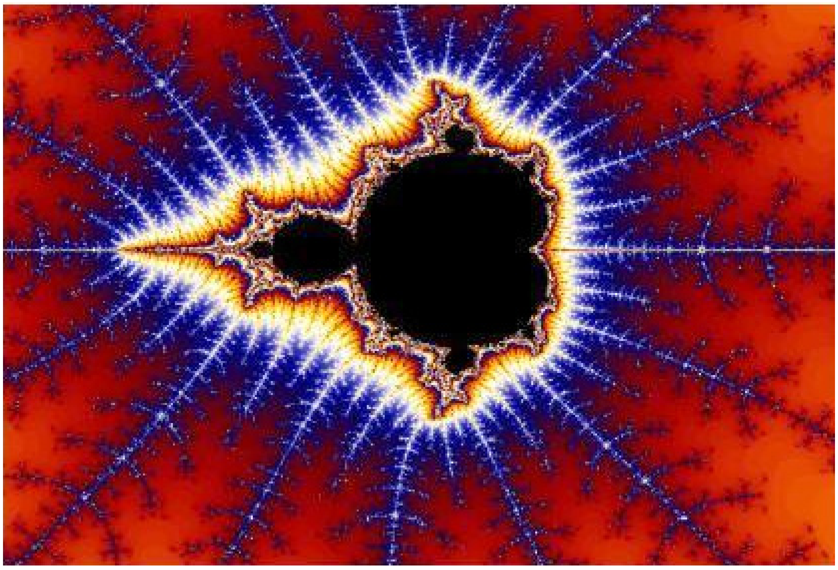
Julia set

Recently there has been an introduction of superior iterations in the study of fractals by Negi and Rani (Chaos, Solitons and Fractals 36 (2008) 237-245).In this approach the vehicle used is the Mann iteration, which is more general than the Picard iteration. Let z_0 be an arbitrary element of C. Construct a sequence of points of $\{z_n\}$ in the following manner:

$$z_n = sf(z_{n-1}) + (1-s)z_{n-1}, \quad n = 1,2,...$$

where *s* is a parameter that lies in the unit interval [0, 1].

An example of a superior Mandelbrot set with n=4 and s=0.1 is given below:



Further studies in this direction have been made by S.L Singh, S.N. Mishra and W. Sinkala, in: A new iterative approach to fractal modeling, WSU Research Conference, 25-27 August 2009, East London.

It may be interesting to note that these images may be used for certain commercial purposes including for printing a *Mandela Shirt*

5. Mathematics and Industry

The mathematics in “industry” that needs the attention of mathematicians typically arises from a mixture of fields tied to the missions of industrial and governmental organizations. Successful industrial mathematicians contributing to their organization’s mission, are interested in working on new areas of application, possess both breadth and depth in mathematics, have good interpersonal skills, and are adept at computation.

In general, the area of expertise of a mathematician in industry may not remain the same as that defined by their dissertation. However, managers often view completion of higher degrees such a doctorate degree as evidence of ability to exert sustained effort to solve a difficult problem rather than as training in a particular specialty that will occupy a professional lifetime. If mathematicians are functioning largely as consultants or if the demands of the organization’s mission lead to shifts in technical requirements, it may be impossible or professionally undesirable for a mathematician to work on only a single specialty. Because of both the interdisciplinary and varied natures of their technical problems, nonacademic employers strongly prefer mathematicians with an interest in applications. The most valued computational skills obviously depend on the context and cannot be prescribed in advance.

Problems in industrial mathematics can arise from anywhere, most often in poorly defined and evolving forms. Mathematicians are valued because they can see and understand the inner nature of a problem, determine which features matter and which do not, and develop a mathematical representation that conveys the essence of the problem and can be solved numerically or otherwise.

Here are some of the attributes of an applied mathematician working in industry:

Mathematicians do not always know the answers, but they know the right questions to ask and they know when the questions being asked are wrong.

- Mathematicians are better equipped than others in coming up with the correct definitions of problems and developing the right level of abstraction.
- Mathematicians have an ability to deal with abstraction, uncoupled from specific technology and involving many subsystems; to develop models for the abstract systems; to use a common language (mathematics) to communicate the results; and to apply well-developed skills to spot hidden gaps and identify connections.
- The key idea is not that mathematicians are ignorant of details, but that their training equips them to deal with problems at an abstract, system-wide level, independently of commitments to a particular approach or technology.

In the life of a nonacademic mathematician, two themes not traditionally associated with core academic mathematics emerge clearly:

- Problem formulation as an interactive and continuing process.
- Collaboration and communication on several levels.

The first of these themes has been emphasized repeatedly during various surveys. Industrial problems are almost never stated in mathematical form when first presented to a nonacademic mathematician; and even if they are posed initially in mathematical terms, alternative formulations may eventually turn out to be preferable. Consequently, successful nonacademic work demands the ability to understand problems couched in terminology from another field, and to discern and analyze the important underlying mathematical structures and questions. There are many challenges for a mathematician working in industry:

- The hardest task for a mathematician is developing the real problem requirements. The user does not usually know what the solution will look like in the end.
- Sometimes customers recognize the problems. In other cases, all they can do is express their frustration and you must figure out the problem.
- For a nonacademic mathematician, "solving" a problem usually does not mean a tidy theorem or counterexample, or even one-time numerical results. It is essentially never the case that someone comes in and says "*Here is a differential equation;* please solve it'', and then that's the end of the story. The mathematics presented in the first discussion is usually the tip of the iceberg.

In addition to dealing with shifting problem formulations, industrial mathematicians are expected to provide "answers" even when no rigorous solution can be found. Timely, useful results, albeit incomplete, are often of critical importance, especially during the process of problem formulation. In some instances, it is more productive to expose quickly a potentially defective formulation than to work out a lengthy complete solution.

- You may be ahead if you find only 80% of the solution if this takes 20% of the work required to find the complete solution.
- Most problems must be "solved" in hours or days; this often means finding an adequate solution rather than a perfect one.
- Industrial mathematicians are usually asked to find the best solution under time and budget constraints.

6. Teaching of Mathematics

A number of changes have taken place in recent years, which have profoundly affected the teaching of mathematics at the university level. Here are some examples:

- The increase in the number of students who are now attending tertiary institutions;

- The major pedagogical and curriculum changes that have taken place at pre university level.
- The increasing differences between secondary and tertiary mathematics education regarding the purposes, goals, teaching approaches and methods.
- The rapid development of technology.
- The demands on universities to be publicly accountable.

Of course, all of these changes are general and have had their influence on other disciplines. However, because of its pivotal position in education generally, and its compulsory nature for many students, it could be argued that these changes have had a greater influence on mathematics than perhaps on any other discipline.

There is no doubt that, in many countries, significantly more students are now entering university and taking mathematics courses than was the case ten years or so ago. However, on the other hand, in a country like South Africa, an increasingly smaller percentage of students appear to be opting for studies, which require substantial amounts of mathematics. Thus, university departments are faced with a double challenge:

- To cope with the influx of students whose preparation, background knowledge and even attitudes are quite different to those of past students.
- They have to attract students to pursue studies in mathematics, where employment opportunities (except the teaching career) and well-paying jobs appear not to be as certain as in some other disciplines such as medicine and business management.

Some new developments in the teaching and learning of mathematics attempt to come to grips with the above issues. For example,

- Alternative approaches to calculus and linear algebra reflect, in part, attempts to make these subjects more engaging and meaningful for the majority of students.
- There have been content changes too, with increased emphasis in some universities on applications and modeling, and so on.

But a general perception remains in some quarters that the teaching of mathematics at the undergraduate level has not to date made sufficient impact in dealing with the backgrounds and needs of present day students. There is also often perceived to be a discontinuity between the teaching of mathematics in secondary schools and the teaching of mathematics in universities. Certainly, the levels of ambition and demand placed on students are increased at the tertiary level.

In the past, responsibility was placed largely on students' shoulders: it was assumed that lecturer's responsibilities were primarily to present material clearly, and that good students would pass and poor ones fail. The climate today is that academic staff is considered to have greater overall responsibility for students' learning. The role of instruction (specifically, of lecturing) and staff accountability are being reconsidered.

Worldwide, increasing use is also being made of computers in mathematics instruction. Much mathematical software and many teaching packages are available for a range of curriculum topics. This, of course, raises such issues as what such software and packages offer to the teaching and learning of the subject, and what potential problems for understanding and reasoning they might generate.

My personal view on this issue is that these teaching aids may be considered as a reinforcement to clarify (and confirm) and to make mathematics visual (or seen as happening) and must not be considered as a replacement for the thinking process. In this context, I would like to quote the following:

- On earth, there is nothing great but man; in man, there is nothing great but mind (W.R. Hamilton, Lectures on Metaphysics, William Blackwood and Sons).
- The real danger is not that computers will begin to think like men, but that men will begin to think like computers (Sydney J. Harris in H. Eves Return to Mathematical Circles, Prindle, Weber and Schimidt, Boston 1988).

7. Research in Mathematics

It may surprise many people that research can still be done in mathematics, as they tend to think that all the useful mathematics has already been discovered. In fact, some 50000 research papers are reviewed annually by Mathematical Reviews.

In mathematics, research has a very special meaning. Specifically, it calls for the creation of new results, that is, either new theorems or radically different and improved proofs of older results. Expository articles, critiques of trends in research, historical articles or books, good texts at any level, and pedagogical studies are usually not considered as research in mathematics.

8. Conclusion

Mathematics is an essential tool for life in its different formations. It cannot be put into a straight jacket and it is very difficult to predict in advance whether a particular type of mathematics could be applicable or not. Throughout the history of mathematics, ideas and inspirations have flowed strongly in both directions between mathematics and applications. The barrier between pure and applied mathematics is artificial, and this observation is in agreement with the following quote by E.T. Bell:

"*The longer mathematics lives the more abstract - and therefore, possibly also the more practical - it becomes.*"

Many academic mathematicians are aware of changes occurring around them, and of experimentation with different teaching approaches. However, they have limited opportunities to embrace these changes owing to logistic and resources and relatively higher teaching commitments.

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In addition to the references specified in the body of the text, the following resources/ references have been used directly or indirectly in drawing up the material for this lecture. I would like to acknowlege them with a deep sense of gratitute.

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ACKNOWLEDGEMENT

I begin by thanking the Walter Sisulu University for providing me the opportunity to serve it for such a long time. I would like to thank the entire WSU management team, particularly, the Vice Chancellor, Professor M. Balintulo for his able leadership; the DVC Academic Affairs and Research, Professor C.L. Obi and the DVC, Planning, Quality Assurance and Development, Professor G.V.C. Buijs for their continued support on different occasions. My special thanks go to Professor S.P. Songca, the Executive Dean, Science, Engineering and Technology for his unfailing support on school matters and Professor G. Ekosse for supporting my research initiatives.

I would also like to thank my previous deans, Professor G. L. Booth, Professor A.M. Sipamala, Professor B.S. Nakani and Mr. F. Gerber for always paying special attention to my proposals and suggestions on faculty matters.

Special thanks are also due to all School Directors in the Faculty of Science, Engineering and Technology (Professor N.D. Jumbam, Dr C. Marsh, Mr. F. Gerber and Mrs. T. Mandindi) for their friendship and cooperation. In the same vein, I extend thanks to my colleagues and staff members in the School of Mathematical and Computational Sciences.

I cannot forget about the many students that have passed through my hands during my long stay at WSU. As much as I am indebted to my colleagues, I owe equally to my students. It has been very gratifying to associate with past students. Many of my students may claim that they have learned a lot from my teaching. But I must say that I have learned so much from them that it would be impossible to adequately express my appreciation for what they have contributed to my life, both professionally and personally.

My special thanks go to the WSU choir for keeping the occasion vibrant.

In the ancient Hindu epic, The Ramayana, it is said that: *“where you live is the most beautiful place and the person who takes care of you is your king.”* It is against this background that I thank the WSU community and the community around for hosting

me so well for eighteen years.

Warm thanks are also due to a number of sister universities, namely University of KwaZulu-Natal, Nelson Mandela Metropolitan University, University of Fort Hare, Rhodes University and Tswane University of Technology. These universities have supported various activities including staff development and holding joint seminars for the last several years. In the same vein, I would like to acknowledge the role the library at Rhodes University has played in my research work. The services of this library have been indispensable all along my research work at WSU.

A time has now come for me to thank my family. I thank my late parents, Mr. Ram Deo Mishra and Mrs. Raj Devi Mishra for their love and care. *As per our tradition, a teacher is also considered as a parent*. Therefore, I thank my mentor and supervisor, the late Professor Pramila Srivastava for her invaluable contributing to shaping my life. Finally, I thank my wife Lalti, our son Brijesh and daughters Suman and Kiran for their unfailing support all along.

Now, I would like to conclude my lecture by the following universal prayer from The Vedas:

Sarve Bhawantu Sukhinah, Sarve Santu Niramayah,
Sarve Bhadrani Pashantu, Ma Kaschit Dukhah Mapnuyat

which translates into English to:

O Lord! In Thee may all be happy; may all be free from misery; may all realize goodness and may no one suffer from pain.

Mr. Vice Chancellor Sir, Ladies and gentlemen,

I THANK YOU.

CITATION FOR PROFESSOR SWAMINATH MISHRA

Professor Swaminath Mishra was born on 1 July 1948 in a farming community to Mr. Ram Deo Mishra and Mrs. Raj Devi Mishra in the northern part of India. He is the last born in a family of two brothers and one sister.

He obtained his doctoral degree (D.Phil) in Science from the University of Allahabad, popularly known as the Oxford of the east, in 1977 on the topic “Some fixed point theorems in metric and uniform spaces for point to point and point to set transformations” under the guidance of the late Professor Pramila Srivastava, the first woman D.Sc. (in mathematics) of Asia. The above thesis was examined, among others, by Professor Kiyoshi Iseki, an eminent topologist from Japan. Professor Swaminath Mishra held the “Empress Victoria Award Fellowship” during his doctoral work.

Between 1977 and 1992 he served at Government College Port Blair of Punjab University (Lecturer), Garhwal University (Lecturer), University of Liberia (Assistant Professor and Acting Chairman of Mathematics), University of Zambia (Lecturer), National University of Lesotho (Senior Lecturer). He joined the University of Transkei as Associate Professor in April 1992 and was promoted to full Professorship in 1996.

He served in various administrative positions at Unitra/WSU since 1992 until to date: Head of Mathematics (and Applied Mathematics) 11 years, Acting Head of Computer Science, 2 and half years, Acting Director of Research Development 3 months. Since January 2009, he has been serving as the Director of School of Mathematical & Computational Sciences. He has served as the Faculty Research Chair for more than 10 years, in addition to serving on various university committees.

He is the Editor of the Indian Journal of Mathematics, Reviewer for Mathematical Reviews and the Zentralblatt fur Mathematik. He is also on the panel of referees for several peer-reviewed journals.

He has published 67 research papers in peer-reviewed journals and has supervised a number of Masters students. He has been external examiner for various Master and Doctoral thesis for universities in South Africa and overseas. He has been an NRF rated scientist (1998-2007) and the thrust leader for the Institutional Research Development Project “Nonlinear Analysis and Applications” (1997-2001). He has given presentations at several national and international conferences.

Professor Mishra is married to Lalti Mishra and has one son (Brijesh) and two daughters (Suman and Kiran) who have their own families. They are settled and working in the United States of America.

APPENDIX

Research Publications of Professor Swaminath Mishra

<u>(Papers published/under publication)</u>

1. On sequences of mappings and fixed points in uniform spaces, Rend. Sem. Mat. 34 (1975-1976),405-410.

2. On common fixed points in uniform spaces II, Indian J. Pure appl. Math. 9(1) (1978),26-30.

3. Remarks on some fixed point theorems in bi-metric spaces, Indian J. Pure Appl. Math. 9(12)(1978), 1271-1274.

4. On sequences of mappings and fixed points in uniform spaces II, Indian J. Pure Appl. Math. 10(6)(1979), 699-703.

5. On fixed points of orbitally continuous maps, Nanta Math. 2(1)(1979), 83-90.

6. Wong's fixed point theorems, Indian J. Pure Appl. Math.12(6)(1981), 671-676.

7. A note on common fixed points of multivalued mappings in uniform spaces, Math. Sem. Notes Kobe Univ. 9(1981), 341-347.

8. On common fixed points of multimappings in uniform spaces, Indian J. Pure Appl. Math. 13(5)(1991), 606-608.

9. Common fixed points and convergence theorems in uniform spaces, Mat. Vesnik. 5(18)(1981), 403-410 (with S.L. Singh).

10. Fixed points of commuting mappings in uniform spaces, Univ. Liberia Res. J.(1983), 57-61.

11. Fixed point theorems in uniform spaces, Resultate der Mathematik 6(1983), 202-206 (with S.L. Singh).

12. Fixed points of multivalued mappings in uniform spaces, Bull. Calc. Math. Soc. 77(1985), 223-229 (with S.L. Singh).

13. General fixed point theorems in probabilistic metric and uniform spaces, Indian J. Math. 29(1) (1987), 9-21 (with S.L. Singh and B.D. Pant).

14. Fixed points of contractive type multivalued mappings in uniformspaces, Indian J. Pure Appl. Math. 18(4)(1987), 283-289.

15. Some coincidence theorems in metric and Banach spaces, Math. Japon. 33(1) (1988), 87-103.

16. Common fixed points for pairs of commuting nonexpansive mappings in convex metric spaces, Math. Japon. 33(5)(1988), 725-735 (with A.K. Kalinde).

17. Common fixed points of compatible mappings, Proc. Seventh SAMSA Symp. (1989), 133-140.

18. Some results on coincidences and fixed points, Rostock. Math. Kolloq. 40(1990), 58-70 (with S.L. Singh).

19. Coincidence theorems in linear topological spaces, J. Natur. Phys. Sci. 4(1-2) (1990),163-178 (with S.L. Singh).

20. Convergence of sequences of multivalued operators, J. Natur. Phys. Sci. 4(1-2) (1990),187-198 (with S.L. Singh and U.C. Gairola).

21. Common fixed points of compatible mappings in PM-spaces, Math. Japon. 36(2)(1991), 283-288.

22. On some fixed point theorems of Argyros, Math. Japon. 37(2)(1992), 329-332 (with S.L. Singh).

23. Common fixed points of maps on fuzzy metric spaces, Internat. J. Math. & Math. Sci. 17(2)(1994), 253-258 (with S.L. Singh and N. Sharma).

24. Coincidence points, hybrid fixed and stationary points of orbitally weakly dissipative maps, Math. Japon. 39(3)(1994), 451-459 (with S.L. Singh).

25. On a fixed point theorem of Yanagi, Indian J. Math.36(2)(1994),103-107 (with S.L. Singh).

26. Nonlinear hybrid contractions on Menger and uniform spaces, Indian J. Pure and Appl. Math. 25(10)(1994), 1039-1052 (with S.L. Singh and Rekha Talwar).

27. Round-off stability of iterations on product spaces, Comptes Rendus Mathematiques 16(3)(1994),105-109 (with S.L. Singh and V. Chadha) .

28. Nonlinear hybrid contractions, J. Natur. Phys. Sci.(5-8)(1991-1994), 191-206 (with S.L. Singh).

29. Almost fixed point property of nonexpansive mappings, Rostock Math. Kolloq.48(1995), 47-52.

30. Contractors on random normed spaces, Bull. Calc. Math. Soc. 87(1995),107-112 (with S.L. Singh) .

31. Fixed point Ishikawa iteration in a convex metric space, Comptes Rendus Mathematiques 17(4)(1995), 153-158.

32. Coincidences and fixed points of nonexpansive type multivalued and singlevalued maps, Indian J. Pure and Appl. Math. 26(5)(1995), 393-401 (with M. Chandra, S.L. Singh and B.E. Rhoades).

33. Some results on common fixed points of compatible mappings, Demonstratio Math. 29(3)(1996), 485-492 .

34. Fixed point theorems in a locally convex space, Quaestiones Math. 19(3-4) (1996), 505-515 (with S.L. Singh).

35. Some remarks on coincidences and fixed points ,Comptes Rendus Mathematiques 18(2-3)(1996), 66-70 (with S.L. Singh).

36. Remarks on recent fixed point theorems for compatible maps, Internat. J. Math. & Math. Sci. 19(4) (1996), 801-804 (with S.L. Singh and V. Chadha).

37. Iterative construction of fixed points, Numer. Funct. Anal. Optimiz. 17(5-6)(1996), 473-501 (with A.K. Kalinde).

38. Remarks on Jachymski's fixed point theorems for compatible maps, Indian J. Pure Appl. Math. 28(5)(1997), 611-615 (with S.L. Singh).

39. A family of nonlinear second order integro- differential equations in physical phenomena, J. Indian Math. Soc.N.S) 63(1997) (with S.L. Singh).

40. Coincidence and fixedpoint theorems on product spaces, Demonstratio Math. 30(1) (1997), 15-24 (with U.C. Gairola and S.L. Singh).

41. Coincidences and fixed points in fuzzy metric spaces, Indian J. Math. 38(2) (1998), 101-112 (with S.L. Singh and V. Chadha).

42. A note on an Ishikawa type iteration sheme, Demonstratio Math. 31(3)(1998), 587- 594 (with A.K. Kalinde).

43. On general hybrid contractions, J. Austral. Math. Soc. Ser. A 66(1999), 244-254 (with S.L.Singh).

44. On finitistic spaces, Topology and its Applications 97(1999), 217- 229 (with J.Dydak and R.A. Shukla).

45. Common fixed point theorems with applications to nonlinear integral equations, Demonstratio Math. 32(3) (1999), 547-564 (with H.K. Pathak and A.K. Kalinde).

46. Fixed points via w-compatibility of type (P), Soochow J. Math. 26(2)(2000), 103-116 (with H.K. Pathak).

47. Some results related to Caristi's fixed point theorem and Ekeland's variational principle, Demonstratio Math. 34(4) (2001), 859-872 (with H.K. Pathak).

48. Some minimization theorems for fixed point theorems in fuzzy metric spaces with applications, J. Fuzzy Mathematics 9(2) (2001), 353-364 (with H.K. Pathak).

49. A note on fuzzy Volterra- Hammerstein integral equations, J. Fuzzy Mathematics 9(2)(2001), 413-419 (with H.K. Pathak).

50. Remarks on recent fixed point theorems and applications to integral equations, Demonstratio Math. 34(4)(2001), 847-857 (with S.L. Singh).

51. Coincidences and fixed points for nonself hybrid contractions, J. Math. Anal. Appl. 256 (2001), 486-497 (with S.L. Singh).

52. On a Ljubomir Ciric fixed point theorem for nonexpansive type maps with applications, Indian J. Pure Appl. Math. 33(4)(2002), 531-544 (with S.L. Singh).

53. Coincidences and fixed points of reciprocally continuous and compatible hybrid maps, Int. J. Math. Math. Sci. 30(10)(2002.), 627-635 (with S.L. Singh).

54. Some Gregus type common fixed point theorems with applications, Demonstratio Math. 36(2)(2003), 413-426 (with H.K. Pathak and A.K. Kalinde).

55. Coincidence points for hybrid mappings, Rostock Math. Kolloq. 58(2004), 67-85 (with H.K. Pathak).

56. Stability of iteration procedures for multivalued mappings, Demonstratio Math. 38 (4)(2005), 905-916 (with S.L. Singh and Charu Bhatnagar).
57. Some results on common fixed points with applications, Fixed Point Theory 6(2) (2005), 285-301 (with A.K. Kalinde and H.K. Pathak).

58. Stability of Jungck type iteration procedures, Int. J. Math. Math. Sci. 19(2005), 3035-3043 (with S.L. Singh and Charu Bhatnagar).

59. Some surjectivity conditions for nonlinear accretive type single-valued operators with a closed range in Banach spaces, Fixed Point Theory 7 (1) (2006), 91-102 (with A.K. Kalinde).

60. A note on the weak convergence of a sequence of successive approximations, Demonstratio Math. 39 (3) (2006), 619-624 (with A.K. Kalinde and S.L. Singh).

61. A fixed point theorem for multivalued mappings in uniform space, Journal of Concrete and Applicable Mathematics 5 (4) (2007), 331-336 (with D. Turkoglu and H. Aslan).

62. New fixed point theorems for asymptotically regular multi-valued maps, Nonlinear Analysis, 71 (2009), 3299-3304 (with S.L. Singh and Rajendra Pant).

63. A new approach to superfractals, Chaos, Solitons and Fractals, 42 (2009), 3110-3120 (with S.L. Singh and Sarika Jain).

64. Coincidence theorems for certain classes of hybrid contractions, Fixed Point theory and Applications, Article ID 898109, 2010 (with S.L. Singh).

65. Remarks on recent fixed point theorems, Fixed Point Theory and Applications (under publication) (with S.L. Singh).

66. On certain stability results of Barbet and Nachi, Fixed Point Theory (under publication) (with A. K. Kalinde).

67. Fixed points of generalized asymptotic contractions, Fixed Point Theory (under publication) (with S.L. Singh and Rajendra Pant).

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