

2009 International Workshop of Differential Equations and their Applications

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I was asked by the NCKU organizer of this Workshop, my colleague Professor Yung-fu Fang (方永富), to say a few words of welcome here.

The Workshop with the aforementioned title, is organized by NCKU's Department of Mathematics from the College of Science, National Center for Theoretical Sciences (South) and a colleague, Professor Yuusuke Iso (磯祐介) from Kyoto University's Dept. of Applied Analysis and Complex Dynamical Systems.

I am sure I was bestowed this great honor only because of my administrative title, since I am transparently neither a mathematician nor an applied mathematician. I guess the closest (and highly nonlinear) affinity I have with applied mathematics is that the great applied mathematics society, SIAM (or Society of Industrial and Applied Mathematics,) had its genesis at the university where I began my academic career: Drexel University in Philadelphia. Unfortunately, it slipped away from Drexel before I arrived at the university.

Still, I am a firm believer that if NCKU were to achieve prominence as a comprehensive university, having an intellectually robust mathematics and applied mathematics program matters and it is non-negotiable! For this reason, I am very pleased to see this Workshop is held here on campus.

Ladies and gentlemen, whenever I think about mathematics, I am always amused by a lighter moment of my life. When my daughter was in high school, she played the violin. In one of her performances, the orchestra which accompanied her included an older gentleman in the first violin section. I later found out that this older gentleman is a great mathematician, and his name is Eugenio Calabi, who developed, I am sure you know far more than I do, the so-called Calabi-Yau (丘成桐) manifolds. So, in a sense, while I did not have the opportunity to listen to Calabi talking about mathematics, I did hear him playing the violin! Actually, to me, that is not too regrettable. After all, for me, listening to a mathematics talk is like listening to an Italian opera: *It's beautiful and I don't understand a word of it.*

To our distinguished visitors from abroad and domestic, I like to welcome all of you to sunny Tainan. I like to especially say a special hello to Professor Iso and all your colleagues from Kyoto University. I should let you know that because of our structural, intellectual and historical similarities, NCKU considers your university our "benchmark." We hope that NCKU can enter into a deeper and more sustainable relation with your university so that we can learn more from you.



Since this is a Workshop about differential equations and applications, I cannot help myself to mention one of the



first, if not the first of such an effort, and what a glorious effort it was. I am sure you can guess which effort I am referring to. It was the “creation” of the differential equations by James Clark Maxwell, whose name sake equations fundamentally and totally explained electromagnetic radiations.

Of course, even for Maxwell equations, there were skeptics, as I am sure you will find yours in your work. Maxwell's “critic,” if you can call him that, was the great Michael Faraday. He wrote the following critique about Maxwell equations:

“The attention of two very able men and eminent mathematicians (Lord Kelvin and Sir James Clark Maxwell) has fallen upon my proposition to represent the magnetic force; and it is to me a source of great gratification and much encouragement to find that they affirm the truthfulness and generality of the method of representation.”

This is obviously one of the most elegant ways of saying “*I find it hard to believe that these equations can represent the complex phenomena so well!*” To criticize with such elegance is truly an art that is no longer present today!

I am sure most of you have heard the joke about “rephrasing” the third verse of Chapter 1 of the Book of Genesis into

“...and God said, let there be Maxwell equations, and there was light!”

I thought this “joke” truly tells the power of mathematics in that for some “unknown” reasons, Maxwell was able to come up with something so simple and elegant to totally describe something so profound and pervasive. When nature created light, did it have such a simple description in mind? Did Maxwell “invented” these equations, or “discovered” them?

Mathematics and applied mathematics are intellectually ubiquitous. This is made abundantly clear in the range of topics covered in this Workshop. In 2005, I attended a conference in Mexico whose main topic was to apply differential geometry and low dimensional topology (or knots theory) to unravel the DNA structures. It was truly an eye-opening event for me, because at the meeting, I saw biological scientists discussing intensely with applied and pure mathematicians.

During my professional career, which included my dabbling into mathematical physics, I have always marveled and was, and still am, deeply impressed that for a mathematician, a sphere is a coset space called $SU(2)/U(1)$ and a plane is a coset space of $H(4)/U(1)$. Such mathematical characterizations, and indeed their generalizations, have unlocked the doors for mathematicians to travel into the deepest areas of human thoughts. These coset spaces, for example, may be an opportunity for physicists to apply them to study the “quantum phase space,” a concept which is important in understanding the elusive “quantum chaos.” Ever

since, I knew that never a mathematician could I be. I learned this many years ago such intricacies from my former student and now an excellent NCKU distinguished theoretical physics professor Wei-Min Zhang (張為民.)

Still, maybe because of my limited knowledge of mathematics, I have always enjoyed listening to great mathematicians speak (opera singing notwithstanding.) In fact, on May 23rd, 1989 in Philadelphia, I was privileged to invite the great late-Chern to talk on “*What is Geometry.*” I should mention that the great late-Chern (陳省身) had a “non-linear connection” to NCKU in that his son-in-law, Paul Chu (朱經武,) is a NCKU distinguished alumnus. Paul who for nearly the entire first decade of the 21st century, was the president of Hong Kong University of Science and

Technology and is of course a globally known scientist; among his many scientific achievements included the co-discovery of high temperature superconductivity!



Nevertheless, “armed” with that small and dangerous (and I am sure you would call insignificant) knowledge of mathematics, it has given me a deep belief as a university administrator that an irreducible component of an institution of higher learning must absolutely be that it has outstanding mathematics and applied mathematics intellectual efforts if it were to reach the highest level of excellence. It is for this reason that I am so enthusiastic about your Workshop.

I hope you reach your goal in this Workshop.

For the foreign guests, I hope you have an enjoyable time in Tainan.

Thank you for your attention

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