A Second Course on
" the Gradual Abandonment of many types of well known Experimental Based Models in favor of a more Universal Algebraic Theory from the General Application of a Unified Theory of Analytical Integration "

By Mike Mikalajunas, CIME

Course Location: *"Out of The Blue"* Resort, Crete Greece.

General Overview

This course is a continuation of the first one that was given in Panama last year at the SIPS 2023 conference.
https://www.flogen.org/sips2023/page.php?p=39#top4
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For this year our primary objective will always remain the same in providing a more transparent method of solution for resolving the current major limitation of Calculus in terms of not being able to arrive at some form of a *unified theory of analytical integration.*

Our own unique method of solution was presented at the last SIPS Workshop in the form of *Specialized Differential Forms* or SDF for short with some major applications in the field of Mechanics of Material , Fluid Mechanics, Quantum Mechanics and even in Cosmology.

This year we will be expanding our new method of solution into the field of medicine by demonstrating how the unique mathematical properties of SDF would play a very significant role in the development of more advanced and reliable *theoretical models* for the human body. This would require performing a complete analysis on general analytical solutions obtained using the unique computational feature of SDF on the *Navier-Stokes* equations for the Mechanical aspect and on the *Schrödinger* equation for the Chemical aspect of the human body.

Currently there exist no such advanced theoretical models of the human body that would be based entirely on general analytical solutions of PDEs because of the severe limitation of Calculus which if successfully resolved by the method of SDF would become immeasurable in terms of reducing our excessive dependency on the use of experimental models in favor of a more universal algebraic theory for the Physical and Biological sciences.

Course Outline

On the first day of this course there will be a brief review of the general mathematical foundation of SDF.

Afterwards I will be revealing a very important mathematical property of SDF that has led to redefining the whole concept of a Composite Function in terms of providing us with a very practical way of measuring its degree of composition regardless of whether or not they are originally defined in either explicit or in implicit form. This would make it possible to extend the scope of new potential forms of explicitly and implicitly defined analytical solutions to PDEs by including Composite Functions with varying degree of composition.

As a result of this very important mathematical property of SDF I will be making a short presentation on a number of very specific cases not previously covered in my first course by which the method of SDF would be applicable for solving a surprisingly large number of new mathematical problems some of which would be considered of major historical proportion.

Next, we will apply our new method of solution to the *Navier-Stokes* equations by providing more generalized analytical solutions that would also include the use of Composite Functions where each of their degree of composition would be determined by computation only in accordance to the unique mathematical properties of SDF.

The same representation of analytical solution involving Composite Functions for the *Navier-Stokes* equations will be applied to the time dependent and independent *Schrödinger* equation for uni-electron and multi-electron structure as a complete replacement for existing methods of analytical solutions which currently do not include as basis functions the use of Composite Functions with varying degree of composition each of which can only be determined by computation only. The inclusion of such type of Composite Functions could potentially result towards a much better understanding of general wave properties so predominant throughout our entire universe by allowing the arguments of algebraic and elementary functions to include other more complex algebraic and elementary functions as well with no restriction whatsoever on the level of composition involved.

Such a unique representation of general analytical solutions to the *Navier-Stokes* could potentially result towards a much better understanding of the Mechanical aspect of the human body while for the *Schrödinger* equation this would be used mainly for handling the Chemical aspect of the human body.

Albert Einstein upon realizing that experimental based models often lead to physical contradictions once quoted the following from his book on the theory of relatively :

" ... this does not seem to be in accordance with continuum theory, and must lead to an attempt to find a purely algebraic theory for the description of reality. But nobody knows how to obtain the basis of such a theory. " Albert Einstein, "The meaning of Relativity" , Princeton Paperback, Fifth Edition ISBN 0-691-022352-2 1974.

Such reoccurring physical contradictions that he experienced in his lifetime could have been resolved entirely from the application of more *coherent theoretical models* that can only be constructed starting with a universal algebraic theory.

Finally at the end of the second day, there will be a special round table discussion on the use of *Artificial Intelligence* for investigating the real beneficial impact for the Physical and Biological Sciences in automating the entire computational process of finding general analytical solutions to PDEs based entirely on the unique computational aspect of SDF.

Day 1: Time and Location to be determined

Mathematics: *Mathematical foundation of Specialized Differential Forms*

- Brief review on the theory of *specialized differential forms* as a *unified theory of analytical integration* for the representation of all *explicitly* and *implicitly* defined equations consisting of only the algebraic and elementary function in terms of specialized differential forms that can be applied for finding general analytical solutions to *any type* of DEs and systems of DEs.
- Comprehensive detailed numerical results obtained from the application of *Specialized Differential Forms* to solving for a *"general"* first order ODE and a second order PDE.
- Basic computer algorithms for calculating the various partial derivatives of an SDF that can be applied for integrating a PDE or a systems of PDEs in terms of generalized analytical solutions involving only the algebraic and elementary functions.

Day 2: Time and Location to be determined

SDF in Fluid Mechanics: *The Navier Stokes Equations*

- Quick review on a very specific case by which our *specialized differential form* representation of all mathematical equations can be applied to solving for the *Navier-Stokes* equations involving heat transfer and variable viscosity for an incompressible fluid without requiring the use of any type of conventional transformation processes.
- General numerical algorithms that can be applied in conjunction with *Artificial Intelligence* for attempting to integrate the *Navier-Stokes* only in terms of generalized analytical solutions defined in either explicit or in implicit form.

SDF in Quantum Mechanics: *The Schrödinger Equation*

- Some preliminary concepts on what led to the derivation of the *Schrödinger* equation.
- How the use of *specialized differential form* representation of all mathematical equations can be applied for attempting to solve the *Schrödinger* equation on a more universal scale by including the use of Composite Function with varying degree of composition.

SDF in Medicine: ***Building better Theoretical Models for the Human Body***

- How the *Navier-Stokes* equations in conjunction with the *Schrödinger* equation can represent a very effective and powerful modeling tool of analysis for the human body thereby over time reducing our excessive dependency on the use of experimental based models in favor of a more universal algebraic theory.
- A new approach to medicine for the construction of new and innovative theoretical models of the human body based entirely on the numerical application of SDF in conjunction with the use of *Artificial Intelligence* for finding only general analytical solutions to the *Navier-Stokes* equations and the *Schrödinger* equation.

Round Table Discussion: ***New innovations in Artificial Intelligence for solving PDEs***

- An open discussion on the discovery of new forms of *Artificial Intelligence* that can be applied directly for completely automating the entire computational process of solving for PDEs and even systems of PDEs only in terms of generalized analytical solutions involving the use of Composite Functions with varying degree of composition defined in explicit or in implicit form.

Who Should Attend

- All those who have participated at the last SIPS 2023 in Panama last year.
- Professors and graduate students who conduct advanced Scientific and Engineering research on various types of projects in the Physical and Biological Sciences.
- Professors and graduate students in Pure and Applied Mathematics always seeking for new innovative methods of "*analytical*" integration that preferably would be driven entirely by computation only.
- Professors and graduate students in Computer Science with a strong background on the use of *Quantum Computers* for applications into the field of *Artificial Intelligence.*
- Physicists and Biologists seeking to improve their method of analysis by becoming less and less dependent on the use of experimental models in favor of a more universal algebraic theory.

Course Instructor Mike Mikalajunas CIME

Mike Mikalajunas has a degree in Mechanical Engineering with specialization in Fluid Mechanics and Thermodynamics. He has taken part in a number of research projects with various faculty members from different departments in the same University where he graduated from. This would include a long term flight simulation project in conjunction with the department of Mechanical Engineering and Canadian Aviation Electronics (CAE). Also included are some software development work related to a program called AUTO, "*Continuation and Bifurcation Problems in Ordinary Differential Equations"* http://indy.cs.concordia.ca/auto/ in conjunction with the department of Computer Science.

Other professional activities going as far back as in the mid 80's included taking part with Dr. Robert Carbone for the launching of a new software consulting company that would provide much greater software accessibility on the PC for large corporations as an alternative to the use of very expensive mainframe computer systems. More information can be obtained by going to http://futurcast.com/ where many of his programs are still being used in large corporations some of which with a total revenue far exceeding $100 Million. They would include *Astra Zeneca, Bayer, Boehringer Ingelheim, Bray Valve & Controls, Bway Aerosol division, Campbell Soup, GlaxoSmithKline (GSK), Glaxo-Egypt, Honeywell, John Crane, Lever Ponds, Merck Frost, Novartis International, Ortho Pharmaceuticals, Roche, Sanofi Aventis, Solvay, Unilever, Upsher-Smith, and Worthington Industries*. Because of his extensive background in C++ and Oracle, Mike Mikalajunas has for many years been assigned to maintaining and supporting the company's own leading Futurcast statistical software package within the giant pharmaceutical company Boehringer Ingelheim. Under a special license agreement he would be responsible in part for running the entire sales forecasting and assumption reporting software on a monthly basis for the international division of Boehringer Ingelheim that provide services to over 100 countries from around the world in order to meet each of the countries own total manufacturing process requirements.

Mike Mikalajunas was also very extensively involved in the search for some form of a *unified theory of analytical integration* that would be driven entirely by *computation* only. His preliminary results in the form of a universal computational algorithm were made public between 1981 and 1983 to various professional conferences involving three of the largest mathematical societies in the world, (1) "*New algorithm for integrating PDEs"* (SIAM) 1981 Fall Meeting, Cincinnati Ohio (2) *"Representing a PDE in terms of an infinite variety of integrable and non-integrable systems of ODEs"* Abstracts of the American Math Society Vol. 4, Number 5, 87th summer meeting, Albany NY 1983 and (3) *"On the use of Multivariate Polynomials for integrating ODEs"* invited 1 hour address to the Mathematical Association of America (MAA) NY State Mathematical Assoc. of Two Year Colleges, Seaway Section, Spring 1983, Utica NY.

In 2015, the new computational algorithm received general acceptance for presentation at 2 major International Conferences on Computational Methods in Auckland New Zealand (ICCM2015) and at Berkeley University (ICCM2016). This was followed by another one in Melbourne Australia "*13th International Conference on the Mechanical Behavior of Materials, June 2019*".

Also between 2015 and 2022 many Universities have expressed a great deal of interest for the presentation of his work at one of their regular internal seminars in Engineering and Mathematics. These included from the department of Mechanical Engineering, *Carleton University*, *University* of *California at Davis* and the *University of Memphis*. Also included, the *Purdue School of Engineering & Technology* in Indianapolis, the *School of Engineering Science* at *Simon Fraser University* and finally, the department of Mathematics at *the City University of New York.*

This has also attracted some degree of interest from NASA which as a result of having attended one of their highly advanced Physics Workshop "*NASA Fundamental Physics Workshop April, 2018, La Jolla, CA*", was given the opportunity to make a presentation at their Washington DC headquarters on the use of his own unique computational algorithm for attempting to resolve many of the various cases of the Navier-Stokes equations in more generalized analytical form, *"A method of differential analysis for solving the Navier-Stokes equations in more generalized form"*, NASA Headquarters, June 2018, Washington DC.

At the SIPS 2022 meeting in Thailand, Mike Mikalajunas presented a total of three abstracts from which the first one was given at the *Horstemeyer International Symposium* and the remaining two as a Keynote Speaker at the *5th Intl. Symp. on Sustainable Mathematics Applications*.

Each of these three presentations were so well received that it prompted the organizers of SIPS to allow him to further expand his ideas into a special Workshop that took place at the last SIPS 2023 conference in Panama.

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