Contributed Papers
Communications libres
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BHAGWAN AGGARWALA, University of Calgary
Effect of Antibodies on an HIV Positive Patient

After the viral count of an hiv positive patient reaches a set point, the patient stays asymptomatic for a number of years. During this period, his viral count slowly goes up, while his CD4 + T - cell count comes down slowly, very slowly. If there is no intervention from antiretroviral drugs, after about ten years or so, his CD4 + T cell count comes down to below a critical level and his immune system is no more able to fight the opportunistic infections. The patient is now terminally sick and usually dies in a couple of years. We develop a Mathematical model to explain this phenomenon and speculate that the viral count goes up (and CD4+ T cell count comes down) because of the virus mutation. The hiv virus is extremely prone to mutation and the mutated virus is not as well recognized by the immune system as the wild type virus, to which type the immune system was initially designed to fight. This leads to the immune system being progressively less efficient which leads to the virus count slowly going up and the CD4+ T cell count slowly coming down. In time, the immune system is "defeated" by the virus. This is when the virus count of the patient shoots up and he/she develops AIDS.

ABDULRASOOL AZIZI, Department of Mathematics of Shiraz University
On generalization of Nakayama's Lemma

Let R be a commutative ring with identity. We will say that an R-module M has Nakayama property, if $IM = M$, where I is an ideal of R, implies that there exists $a \in R$ such that $aM = 0$ and $a - 1 \in I$.

Nakayama's Lemma is a well-known result which states that every finitely generated R-module has Nakayama property.

In this note, we will study Nakayama property for modules. It is proved that R is a perfect ring if and only if every R-module has Nakayama property.

ADAM FELIX, University of Alberta
A Problem of Fomenko's related to Artin's Conjecture on Primitive Roots

Let a be a fixed, squarefree integer. In 1927, Artin conjectured that a is a primitive root modulo p for a positive proportion of primes up to x. Hooley has shown that this is true upon the GRH. We view this conjecture in a different light and consider a generalization. In particular, let $i_a(p) := [(\mathbb{Z}/p\mathbb{Z})^* :< amodp >]$. Then, we consider summations of the form

$$\sum_{p \le x} f(i_a(p))$$

where $f : \mathbb{N} \to \mathbb{C}$ is a function. We will see that for a large class of functions, the above summation satisfies

$$\sum_{p \le x} (log(i_a(p)))^\alpha = c_a \pi(x) + O(x/(logx)^{2-\varepsilon-\alpha})$$

for any $\alpha \in (0,1)$ and $\varepsilon > 0$, and where c_a is a constant dependent on a, and

$$\sum_{p \le x} \tau(i_a(p)) = c'_a \pi(x) + O(x/(\log x)^{2-\varepsilon})$$

for any $\varepsilon > 0$ and where c'_a is a constant dependent on a.

HIMADRI GANGULI, Simon Fraser University
On the equation $f(g(x)) = f(x)h^m(x)$ for composite polynomials

In recent past we were interested to study some special composition of polynomial equation $f(g(x)) = f(x)h^m(x)$ where f, g and h are unknown polynomials with coefficients in arbitrary field K, f is non-constant and separable, $\deg g \geq 2$, $g' \neq 0$ and the integer power $m \geq 2$ is not divisible by the characteristic of the field K. In this talk we prove that this equation has no solutions if $\deg f \geq 3$. If $\deg f = 2$, we prove that $m = 2$ and give all solutions explicitly in terms of Chebyshev polynomials. The diophantine applications for such polynomials f, g, h with rational or integer coefficients are considered in the context of the conjecture of Cassaigne et. al. on the values of Louiville's λ function at points $f(r)$, for any rational r. This is joint work with Jonas Jankauskas.

MD. KAMRUJJAMAN, University of Calgary, AB, Canada
Effect of Oscillating surface temperature due to time dependent free stream velocity on mixed convection flow along a horizontal

Effect of Oscillating surface temperature due to time dependent free stream velocity on mixed convection flow along a horizontal circular cylinder

Abstract:The effect of small amplitude oscillations of the surface temperature with time dependent free stream velocity on mixed convection flow of a viscous incompressible fluid along a horizontal circular cylinder is considered. The problem is simplified by employing the laminar boundary layer and Boussinesq approximations. Implicit finite-difference scheme is used to solve the dimensionless governing equations. Where solutions are obtained as functions of the curvature parameter X on the entire surface of the cylinder [0,π]. The results are shown graphically in terms of amplitude and phase of the Nusselt number for fluids having Prandtl number, Pr=1.0 and for different values of a mixed convection parameter λ. Streamlines and isotherms as well as transient shear stress and heat transfer are also represented for the effect of λ and frequency parameter ω.

NISHAN CHARITHA MUDALIGE, University of Guelph
The Geometry of Higher Rank Numerical Ranges

The higher rank numerical range is a recent discovery that was first introduced by Choi, Kribs and Zyczkowski in 2006. In this talk we will discuss the geometry of the higher rank numerical range of normal operators in detail. In general the higher rank numerical range of an operator is not a polygon, however when we consider normal operators the higher rank numerical range is a polygon in the complex plane $\mathbb{C}$. We will put several bounds on the number of sides of the polygons that are formed by normal operators. We will focus on unitary operators as well as the general case of normal operators.

This work was done in collaboration with Dr. J. Holbrook and Dr. R. Pereira of the University of Guelph.

RICHARD MIKAEL SLEVINSKY, University of Alberta
A comparative study of extrapolation methods, sequence transformations and steepest descent methods for semi-infinite integrals

With the advent of computers and scientific computing, there has been a push to develop more accurate, more efficient, and more reliable techniques in computing challenging problems in applied mathematics. In the numerical evaluation of infinite-range integrals, a common problem in applied mathematics, three general methods have come to the forefront, and have done so largely through independent trains of thought. To wit, these methods are known as extrapolation methods, sequence transformations and steepest descent methods.

In extrapolation methods, through numerical quadrature or otherwise, one computes a sequence of approximations to the infinite-range integral and uses analytical properties of the integrand to then extrapolate on this sequence to obtain an approximation for the integral. In sequence transformations, one derives the asymptotic series expansion of the integral and, whether convergent or divergent, one applies transformations to the asymptotic series hoping to approximate the limit or antilimit of the series with a relatively small number of terms. In the steepest descent methods, a deformation of the path of integration is used to transform oscillations or irregular exponential behaviour into linear exponential decay. On the deformed contour, a Gauss-Laguerre-type quadrature is used to approximate the integral.

In this work, we put these three general methods to the test on five prototypical infinite-range integrals exhibiting oscillatory, logarithmic and exponential properties or combinations thereof. On the bases of accuracy, efficiency, simplicity, and reliability, we compare and contrast the three general methods for the evaluation of infinite-range integrals.

TARA TAYLOR, St. Francis Xavier University
Using Cantor Sets to Study the Connectivity of Sierpinski Relatives

This paper presents an exploration of the connectivity of the class of fractals known as the Sierpinski relatives. The Sierpinski gasket (or triangle) is the most well-known relative. The relatives are attractors of iterated function systems that involve the same contractive mappings as for the gasket, combined with symmetries of the square. These relatives all have the same fractal dimension, but different topologies. Some are totally disconnected, some are disconnected with non-trivial paths, some are simply-connected, and some are multiply-connected. For some of the relatives, one can determine the connectivity by considering certain Cantor sets that are relevant subsets. These Cantor sets are variations of the usual middle thirds Cantor set, and can be viewed in binary instead of ternary.