Bilal AL TAKI

Sorbonne Université
Laboratoire Jacques-Louis Lions
4 Place Jussieu, 75005 Paris

Born on: 22 March 1991
e-mail : bilal.altaki.math@gmail.com

Web Page: https://altaki.github.io/Welcome-to-my-Home-Page/

Teaching statement

Here is a brief description of my various teachings that I carried out during my career. My first position was as a temporary lecturer at the University of Savoie Mont Blanc, then I pursued a Postdoc & ATER position at Sorbonne University, furthermore I gave lectures as an invited researcher at the Lebanese University. Throughout my career, I have been assigned to carry out the exercises related to the courses given by my colleagues (except the last one). The number of credits mentioned hereafter corresponds to my own teachings.

All the courses were given on campus. However, I am able to teach courses using digital platforms especially in the current situation.

University of Savoie Mont Blanc (Temporary lecturer: 2016-2017)

- Course: Real Analysis (first academic year)

Academic year: 2016/2017	Credits: 32h
Attending students: 32	Course: C. Bourdarias and B. Al Taki

In this course we discuss the following concepts: Real and complex numbers, Logic and sets (logical operators, Quantifiers, Demonstration techniques), Real and complex sequences, Functions of a real variable, Finite expansions, Bijective functions, Logarithm and exponential, Trigonometric functions.

- Course: Functional analysis (first academic year)

Academic year: 2016/2017	Credits: 32h
Attending students: 32	Course: P. Barras and B. Al Taki

In this course we discuss the following concepts: Intervals of $\mathbb{R}$, Upper and lower bounds, Numerical sequences (arithmetic and geometric), Theorems of convergence of sequences (monotonic, adjacent, recurring and extracted sequences), Real functions (minor, major and bounded functions), Parity and periodicity of a function, Limits and continuity, Reciprocal functions, Derivatives of usual functions, Local Extremum, Mean value theorem.

- Course: Statistics (second academic year)

Academic year: 2016/2017	Credits: 32h
Attending students: 32	Course: L. Vuillon and B. Al Taki

In this course we deal with the following notions: Introduction, Addition and multiplication law of probability, Conditional probability, Random variables (Discrete and Continuous Random variable), Probability mass function and Probability density function, Expectation and variance, Discrete and Continuous Probability distribution: Binomial, Poisson and Normal distributions.

- Course: Probability and statistics (third academic year)

  Academic year: 2016/2017 Credits: 24h

  Attending students: 36 Course: S. Gerbi and B. Al Taki

In this course we discuss the following concepts: Introduction, Discrete probabilities on subsets of $\mathbb{R}$ (Bernouilli, geometric, etc), Density probabilities on subsets of $\mathbb{R}$ (uniform, beta, exponential, etc), Random variable, Independent variables, Normal Distribution, Chi-2 Distribution, Student Distribution, Fisher-Snedecor Distribution, Hypothesis, Null hypothesis, Alternative hypothesis, Testing a Hypothesis, Level of significance, Confidence limits, Test of significance of difference of means, Empirical mean, Central Limit Theorem, Confidence intervals, Hypothesis tests on means, Homogeneity test : independent samples, Homogeneity test: paired samples.

- Course: Linear Algebra (first academic year)

  Academic year: 2016/2017 Credits: 28h

  Attending students: 34 Course: M. Raibaut and B. Al Taki

In this course we discuss the following concepts: Reminders on set operations, relations on a set, N, Z, Q, Euclidean division, polynomials and rational fractions, vector spaces, sub vector spaces, operations, cases of $\mathbb{R}^2$ and $\mathbb{R}^3$, free families, generators, bases, coordinates, dimension, and so on.

Sorbonne Université (Postdoc (2017-2018) & ATER (2018-2019)& ATER (2021-2022))

- Course: Analysis and Algebra for the science (first academic year)

  Academic year: 2019/2020 Credits: 36h

  Attending students: 38 Course: L. Koelben and B. Al Taki

We approach in this course the various following notions: $\mathbb{R}$: Order and intervals, Limits, Continuity, Derivations, Usual and reciprocal functions, Mean Value theorem, Taylor expansion, First order linear differential equations, The field $\mathbb{C}$ and the complex exponential, Polynomials, Roots, Rational fractions, Euclidean division, $\mathbb{R}^2, \mathbb{R}^3$, Scalar and vector product.

- Course: Vectorial analysis and multiple integral (second academic year).

  Academic year: 2019/2020 Credits: 32h

  Attending students: 33 Course: F. Paugam and B. Al Taki

In this course we deal with the following notions: Limits and continuity, Differential, Primitive and integral calculus, Parametric curves, Vector calculus, Partial and differential derivatives, Contour line, Curvilinear integral, Parametric surface, Implicit function theorem, Multiple integrals, Differential forms.

- Course: Introduction to differential equations (second academic year)

  Academic year: 2019/2020 Credits: 24h

  Attending students: 38 Course: C. Boutillier and B. Al Taki

In this course we discuss the following concepts: Definitions and generalities, Cauchy-Lipschitz statement for first order equations $y' = f(t, y)$, with f globally Lipschitz in the second variable, Scalar first order linear differential equations $x' = px + q$, Matrix exponential, Linear differential equations with constant coefficients (Adaptation of the method of variation of the constant), Phase spaces, Models of population evolution.

• Analysis: Post PACES of Polytech Sorbonne.

Academic year: 2017/2018	Credits: 20h
Attending students: 35	Course: B. Al Taki

The Peib Post-PACES training of the Polytech network is a training that allows students who have done a first year in medicine without passing the exam afterwards, to join the Polytech network in their second year. The reinforcement course that I gave consists of recalling the basic notions of analysis; stating the main theorems of analysis of the first year, and doing some exercises as applications.

• Course: mathematics for scientific studies (first academic year)

Academic year: 2021/2022	Credits: 54h
Attending students: 32	Course: M. Postel and B. Al Taki

We approach in this course the various following notions: $\mathbb{R}$: Order and intervals, Limits, Continuity, Derivations, Usual and reciprocal functions, Mean Value theorem, Taylor expansion, First order linear differential equations, The field $\mathbb{C}$ and the complex exponential, Polynomials, Roots, Rational fractions, Euclidean division, $\mathbb{R}^2, \mathbb{R}^3$, Scalar and vector product.

• Course: TBD (second or third academic year academic)

Academic year: 2021/2022	Credits: 112h
Attending students: ..	Course: .... and B. Al Taki

TBD

Lebanese University (Invited Researcher: 2018-2019)

• Course: model and numerical method in geosciences (Master 2-PDEs).

Academic year: 2018/2019	Credits: 18
Attending students: 15	Course: J. Sainte-Marie and B. Al Taki

The purpose of the part I taught is to present recent mathematical results on the viscous Shallow-Water equations.

$$\begin{cases} \partial_t h + \mathrm{div}(hu) = 0 \\ \partial_t(hu) + \mathrm{div}(hu \otimes u) - \mathrm{div}(2h\,\mathrm{D}(\mathbf{u})) + gh\nabla h = f \end{cases}$$

First, a few words on how to obtain these equations from the incompressible Navier-Stokes equations. Then, we discussed elliptic problem associated with these equations. More precisely, I identified the difficulty introduced by the fact that the water height h can be degenerate at the boundary by studying the following system:

$$\begin{cases} \mathrm{div}(h\,\mathrm{D}(\mathbf{u})) & = f \\ u|_{\partial\Omega} & = 0, \end{cases}$$

with u is the unknown of the system, and f a given function in a L^p space. Indeed, the fact that h can can degenerate prevents us to apply the well known Lax-Milgram theorem's in a classical Sobolev space frame. The existence of a solution in this case could be shown in weighted Sobolev spaces. Therefore, for the complete system, I started by talking about different methods used in the proof of solution existence, notably Galerkin's method and Schauder's fixed point. Then I talked about the difficulties: degeneration of h, non-linear terms. In addition, I made the calculation of different types of energies associated with this system (energy estimation and BD-entropy). The stability of an approximate solution was studied afterwards. I recalled the different notions of compactness which allows us to pass to the limits in nonlinear terms. Finally, I gave some points on the question of construction of an approximate solution.