Danh sách báo cáo

TÓM TẮT BÁO CÁO

Existence results and numerical method for solving a fourth order nonlinear integro-differential equation

D. Q. A[1] **and D. Q. Long**[2]

Abstract: We consider the boundary value problem for a fourth order nonlinear integro-differential equation

$$u^{(4)}(x) = f(x, u(x), u'(x), \int_0^1 k(x,t)u(t)dt),$$
$$u(0) = 0,\ u(1) = 0,\ u''(0) = 0,\ u''(1) = 0,$$

where the functions $f(x, u, v, z)$ and $k(x, t)$ are assumed to be continuous. By the reduction of the problem to operator equation we establish the existence and uniqueness of solution and construct a numerical method for solving it. We prove that the method is of second or third order of accuracy depending on the numerical integration method. Some examples illustrate the theoretical results.

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Qualitative properties of efficient solutions to set optimization problems

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Abstract: In this report we study optimization problems of set-valued mappings on ordered sets. This is a new research direction in optimization, which appeared several decades ago to meet both the theoretical development and practical application demand, and has been extensively investigated so far. The aim of this talk is to provide a comprehensive introduction to the topic, whose content is threefold. Firstly, we discuss two criteria of a solution associated with a set-valued optimization problem, a vector criterion and a set criterion, and investigate some links between their solutions. Secondly, we consider relationships between set optimization problems with some problems related to optimization. Finally, under suitable conditions, we study many qualitative properties of weak/strong or Pareto efficient solutions of such problems.

Keywords: Set optimization problem, vector optimization problem, set less relation, scalarization method

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Continuity of approximate solutions maps to set-valued equilibrium problems

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Abstract: In this talk, we are concerned with parametric set-valued equilibrium problems on normed spaces. Using Gerstewitz nonlinear scalarization functions and relaxed concavity assumptions, we study the Lipschitz property of solution maps to such problems. As an application, we apply the main results to the Browder variational inclusion. The treatment and obtained results for these problems are new and different from the existing ones in the literature.

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Connectedness properties of solution sets to bilevel set optimization problems

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Abstract: In this talk we consider bilevel set optimization problems via set order relations. We first introduce new concepts related to the convex-likeness of set-valued maps, and discuss properties of these maps. Then, based on these properties and the Gerstewizt's function, we analyze and study sufficient conditions for connectedness properties of Pareto solution sets to the bilevel set optimization problems. Our approaches and obtained results are new and different from the existing ones in the literature.

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Existence and well-posedness in uncertain vector optimization problems

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Abstract: Robust optimization is a popular methodology to study vector optimization problems under uncertainty. An uncertain vector optimization problem can be considered through its robust or optimistic counterpart. In this talk, we first formulate the counterparts as set optimization problems and introduce various kinds of efficient solutions to these counterparts. Next, we study sufficient conditions for the existence of such efficient solutions. Finally, we suggest and investigate new concepts related to pointwise well-posedness properties for both the robust and the optimistic counterparts of uncertain vector optimization problems.

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Well-posedness for vector optimization problems under uncertainty

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Abstract: In this talk, we focus our attention on the robust counterparts of uncertain vector optimization problems. We first introduce concepts of robust efficient solutions to the reference problems based on the idea of set less order relations. Next, the concepts of well-posedness for the robust counterparts are proposed. By employing some generalized nonlinear scalarization functions, we study relationships between well-posedness of the reference problems and that of scalar optimization ones. Finally, sufficient conditions of well-posedness for such problems are established.

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Convergence of the solution sets of perturbed optimal control problems

L. Q. Anh[1], V. T. Tai[2], T. T. K. Anh[3], D. M. Nhat[4], and N. C. Thang[5]

Abstract: This talk investigates the existence and stability of solutions to the class optimal control problems under functional perturbations. By using suitable tools and techniques, sufficient conditions for the Painlevé-Kuratowski convergence of the solution sets for the reference problems are established.

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Existence and stability of solutions to equilibrium problems in generalized linear spaces

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Abstract: In this talk, we consider equilibrium problems in generalized linear spaces. We first study sufficient conditions for the nonemptiness of solution sets to equilibrium problems. After that, sufficient conditions for the upper and lower semicontinuity of solution maps to such problems are established.

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Local behavior of a regularized primal–dual method for bound-constrained optimization

P. Armand[1] **and** **T. N. Nguyen**[2]

Abstract: We present a primal-dual algorithm for solving a bound-constrained optimization problem. The algorithm uses a regularization technique to handle the case where the second order sufficient optimality conditions do not hold at a local minimum. The local convergence analysis is done under a weaker assumption and is related to a local error bound condition. It is proved that locally the algorithm is superlinearly convergent. Some examples are given to show the advantage of this new algorithm.

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Autonomous robot with limited vision range: Path planning in environment of uncertainty

T. T. Binh[1], **P. T. An**[2], **and T. V. Hoai**[3]

Abstract: This talk describes an efficient method for a robot in 2D with a limited vision range to find a path to a goal in the environment of the uncertainty of polygonal obstacles. Most path planning algorithms require an adequate map information as input. Hence, they are less realistic and hard to apply to the real world. Our method does not need all map information of a particular place but the coordinate of the goal in the beginning, then the robot discovers the map and finds a path to the goal by itself. It searches on local of the robot's vision range then make prediction base on distance and differential angle from the robot's location to the goal. The advantage of our method is that it reduces the search space because it searches locally. In particular, the computation of the robot is also decreased because it only relies on suitable sequences of line segments of the explored map, not on a fully uncovered map. To prove the feasibility of the proposed method, we use python to simulate an autonomous robot.

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On the asymptotic behavior of evolution equations

D. D. Chau[1]

Abstract: In this talk, we study the asymptotic behavior of the linear differential equation under nonlinear perturbation

$$\frac{dx}{dt} = Ax + f(t, x_t),$$

where $t \in R_+$, $A : E \to E$, $f : R_+ \times E \to E$, and $(T(t))_{t \in R}$ is C_0-group generated by $A, D(A)$. We will give some sufficient conditions for uniformly stable and asymptotic equivalence of the above equation and its application to the model of population.

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Dynamics of non-autonomous quasilinear degenerate parabolic equations: The non-compact case

T. T. Q. Chi[1], L. P. Thuy[2], and N. X. Tu[3]

Abstract: We prove the existence of pullback attractors in various spaces for non-autonomous quasilinear degenerate parabolic equations involving weighted p-Laplacian operators on $\mathbb{R}^N$, under a new condition concerning a variable non-negative diffusivity $\sigma(x)$, an arbitrary polynomial growth order of the nonlinearity f, and an exponential growth of the external force. To overcome the essential difficulty arising due to the unboundedness of the domain, the results are proved by combining the tail estimates method and the asymptotic *a priori* estimate method.

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A reduced maximum likelihood procedure for Hawkes process

D. V. Cuong[1] **and E. Gouno**[2]

Abstract: This work considers parameters estimation issues for the classical Hawkes process. A maximum likelihood procedure for this process was introduced by Ozaki in 1979. Howerver, the convergence of that procedure is unstable with respect to initial points. We introduce a new algorithm to maximize the likelihood of Hawkes process, which is called *a reduced maximum likelihood procedure* (RMLE). Our approach helps to reduce the objective funtion on a three-dimensional space to one on a two-dimensional space. The new objective function makes it easy to investigate graphically so one can choose a good initial point for the Newton-Raphson approximation. A simulation study is performed to show that our procedure gives better estimates than that one of Ozaki.

Keywords: Nonhomogeneous Poisson process, Hawkes process, self-exciting point process, maximum likelihood estimation, simulation.

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The extragradient algorithms with linesearch for solving nonmonotone equilibrium problems in Banach spaces

B. V. Dinh[1], H. D. Manh[2], and T. T. H. Thanh[3]

Abstract: In this paper, we introduce two new extragradient algorithms with linesearch for solving equilibrium problems in real Banach spaces where the bifunctions are not required to satisfy any monotonicity property. Under the assumptions on the continuity, convexity of the bifunction, and the nonemptyness of the solution set of the Minty equilibrium problem, we show that the iterative sequence generated by the first algorithm (resp., by the second algorithm) converges weakly (resp., strongly) to a solution of the primal problem. A numerical example is provided to illustrate the convergence of the proposed algorithms.

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Modelling the interaction between rice and brown plant hopper having insecticide spray factor or wind factor

D. N. Dung[1], **N. D. Anh**[2], **and N. P. Thuy**[3]

Abstract: In this work, two new stage-structured prey-predator models with two time-scales were proposed to study the interaction between rice and Brown Plant Hopper (BPH) having insecticide spray or wind factor. BPH population is assumed to be in two stages: mature which is for the mature stage and juvenile relating to the egg stage. The proposed mathematical models consist of six nonlinear ordinary differential equations in a heterogeneous environment. The spatial interspecific competition with two patches is connected by fast dispersal. Dispersal between patches is assumed to be much faster than local population dynamics on each patch. We take advantage of these time scales in order to reduce the model to an aggregated model governing total densities of mature BPHs at a slow time scale. The positivity and boundedness of the solutions have been derived. The dynamical behavior of the systems was analytically investigated through local stability and global stability. Numerical simulations have been accomplished to illustrate the theoretical results. We also discuss the results from the ecological point of view.

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Starter balanced tournament designs: Construction and applications

H. N. Dung[1], **H. A. Quan**[2], **and M. Rosenfeld**[3]

Abstract: One-factorization of the complete graph K_{2n} has been a challenging, attractive topic in combinatorics and operations research. A balanced tournament design (BTD) of order n is a one-factorization of K_{2n} which schedules $2n$ teams in a round-robin tournament lasting in $2n-1$ days with balanced constraints. In particular, there are n matches taking place in n stadiums simultaneously each day, and the balanced constraints ensure that every team competes at each stadium at most twice. In this talk, we focus on the problem of finding a special type of BTD called starter balanced tournament design (SBTD) in which all one-factors are starters. We transform the problem into a binary ILP model and introduce insightful observations to reduce its complexity. We utilize Gurobi Optimizer to solve the model and obtain SBTDs in a large number of sizes with few gaps. It provides strong evidence that most likely SBTDs exist for almost all sizes. As a collateral benefit, we identify many new rainbow-colored Hamiltonian balanced tournament designs (HBTDs).

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Fuzzy integral for undergraduate admission process

D. T. T. Duong[1], D. T. Dam[2], and H. T. Uyen[3]

Abstract: Information fusion is a broad area that studies methods to combine data or information supplied by multiple sources. Aggregation is one of such process which is used in data analysis to obtain a single value from a set of values. For this purpose the fuzzy integrals like Choquet integral, Sugeno integral can be used as aggregation operators. In decision theory we have to obtain aggregation of the preference values or satisfaction degrees.

Common aggregation operators like arithmetic mean, weighted mean, median, mode etc. have some drawbacks because they only express the quantitative approach. But to express the qualitative approach like relation between criteria, decision making, fuzzy integrals such as the Choquet integral and Sugeno integral are considered.

Admission is the first important mission in education process of universities and colleges and has a great impact on the quality of teaching and learning. Well-constructed admission leads to recruit students with knowledge, skills, and attitudes that are suitable to the vision and core value of the education units, and orientate the learning process of students. To conceive, design and implement mixed criteria are the best-practice solution for admission improvement purpose. For that reason, aggregating information from different criteria into one which applies fuzzy integrals and conducting a research based on a real data set from Vietnam Nation University, Ho Chi Minh City, are the main goals for this paper.

Key word: fuzzy measure, additive measure, fuzzy integral, admission, ranking

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Primal-dual methods for a class of degenerate Hamilton–Jacobi equations

H. Ennaji[1], **N. Igbida**[1], **and N. V. Thanh**[2]

Abstract: We suggest a new approach to solve a class of degenerate Hamilton–Jacobi equations without any assumptions on the emptiness of the Aubry set. It is based on the characterization of the maximal viscosity subsolution by means of the Fenchel–Rockafellar duality. The saddle-point structure allows us to use primal-dual methods as alternatives to commonly used methods for numerical approximation of Hamilton-Jacobi equations, which are usually based on finite difference approximation or on optimal control interpretation of the solution. In this work, we also obtain the convergence of discretization as the mesh size goes to zero. Furthermore, numerical experiments on various problems are presented.

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Second-order optimality conditions and regularity of Lagrange multipliers for mixed optimal control problems governed by semilinear elliptic equations

N. B. Giang[1], **N. Q. Tuan**[2], **and N. H. Son**[3]

Abstract: This talk deals with second-order optimality conditions and regularity of Lagrange multipliers for a class of optimal control problems governed by semilinear elliptic equations with mixed pointwise constraints in which controls act both in the domain and on the boundary. We give some criteria under which the optimality conditions are of KKT type and the multipliers are of L^p-spaces. Moreover, we show that the multipliers are Lipschitz continuous functions.

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Local convergence analysis of augmented Lagrangian methods for convex piecewise linear-quadratic composite optimization problems

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Abstract: Second-order sufficient conditions for local optimality have been playing an important role in local convergence analysis of optimization algorithms. In this paper, we demonstrate that this condition alone suffices to justify the linear convergence of primal-dual sequences, generated by the augmented Lagrangian method (ALM) for convex piecewise linear-quadratic (CPLQ) composite optimization problems, even when the Lagrange multiplier in this class of problems is not unique. This will be achieved by appealing to the concept of the second subderivative and to the theory of twice epi-differentiability of extended-real-valued functions. These tools of second-order generalized differentiation allow us to obtain a second-order characterization of the quadratic growth condition for the partially augmented problem for CPLQ of composite optimization problems, which then becomes indispensable for our convergence analysis of ALM for this class of composite optimization problems with solvability, stability, and local convergence.

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Singular value decomposition: History, theory and applications

D. N. Hao[1]

Abstract: Singular Value Decomposition (SVD) has many applications in science, engineering, statistics, data science, e.g., in image processing, signal processing, least squares fitting of data, process control, solving systems of linear algebraic equations, operator equations (approximate pseudo-inverses), model order reduction etc. This tutorial talk begins with some fundamental notions of linear algebra and functional analysis, such as, eigenvalues, eigenvectors (eigenfunctions), singular values, singular vectors, singular value decomposition with some remarks on their history. Then, some of their important properties are presented. The talk will be ended by some of applications of SVD to different practical problems.

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Inversion of borehole laterolog resistivity data for thin bed detection with reference to oil and gas exploration

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Abstract: Electrical measurements conducted along a borehole are quite challenging as the invaded zone, made of very highly conductive mud cake, may not allow the injected electric current to flow into the formation. To overcome this problem some of the focused electrode configurations such as second difference, lateral (LL) and laterolog-7 (LL7) were developed and applied to force the electric current flow to penetrate better into the oi and gas-bearing formation. Consequently, the measured apparent resistivity can be used as an indicator parameter to detect horizontal bed boundaries, for which the measured apparent resistivity needs to be inverted to the true resistivity. In this presentation, we show a workflow of the electrical resistivity modelling for a specialized electrode configuration, named as laterallog-7 configuration, using finite difference solution in the cylindrical coordinate system. Based on this approach, the Fréchet derivative is derived to invert the laterolog-7 data for further geophysical interpretation and analyses of resistivity logs and estimation of oil reserve. In this particular case study of thin bed detection for the White Rhino oil field in the Cuu Long basin, the inversion was successfully done and helped to detect an oil layer of just about 15 cm thick. Such a thin bed is often missed by conventional well log analysis.

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Output feedback finite-time dissipative control for uncertain nonlinear fractional-order systems

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Abstract: This report presents robustly finite-time dissipativity control problems for uncertain nonlinear fractional-order systems (FOS). Firstly, by using some basic mathematical transformations associated with linear matrix inequality (LMI) techniques, a new condition for the existence of output feedback controllers, which ensures that the closed-loop FOS in question is finite-time stabilizable, is established. Then, based on the proposed stabilization criterion and some well-known properties of fractional calculus, the finite-time dissipativity control problem for nonlinear FOS subject to uncertainties is studied for the first time.

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Dynamics for a system of double free boundary problem in an epidemiological model with nonlocal diffusions

V. H. Hung[1]

Abstract: This talk presents a recent joint work of speaker and his my students about the long time dynamics for a double free boundary system with nonlocal diffusions, which models the transmission of an infectious disease such as the fecal-oral disease, cholera, etc... We first establish the local existence and uniqueness thanks to the contraction mapping theorem. Then, we prove that the solution of free boundary system converges, as $t \to \infty$, either to zeros or positive constant steady states of the nonlinearities, which are conditioned by comparing the basic reproduction numbers R_0 and R^* with some certain numbers. This is called the vanishing/spreading phenomena. To these aims, we must obtain the limits of the principal eigenvalue of the linearized nonlocal system as the dispersal rates and domain tend to zero and infinity. The maximum principle and the sliding method for nonlocal operator are employed to obtain the desired results.

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Effect of cultivating flowers on brown plant hopper invasion in rice fields: An agent-based modeling approach

N. D. Hung[1], T. T. Duong[2], L. T. Hue[3], and N. P. Thuy[4]

Abstract: In this talk, we propose an agent-based model to study the effects of planting flowers on the invasion of Brown Plant Hopper (BPH) in rice fields. BPH is considered as a two-stage-structured population: the former are adults and the latter are eggs and nymphs. In our experiment, we simulated a heterogeneous environment consists of two rice fields with a path of flowers planted in between. This flower path attracts natural enemies of BPH, thus decreasing their number when they reach there. Each of our simulations is equivalent to 120 days, corresponding to a rice season. These simulations outcome suggest the obvious effect of flowered area on the dispersion of BPH in cases with different scenarios: initial BPH number, starting place, the distance between two fields, and whether flowers were planted or not. From the above-stated outcomes, we found emerging results that support decision-making for farmers in dealing with BPH during rice cultivation.

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Well-posedness and regularity for solutions of Caputo stochastic fractional differential equations in L^p spaces

P. T. Huong[1], **P. E. Kloeden**[2], **and T. S. Doan**[3]

Abstract: In the first part of this talk, we establish the well-posedness for solutions of Caputo stochastic fractional differential equations (for short Caputo SFDE) of order $\alpha \in (\frac{1}{2}, 1)$ in L^p spaces with $p \geq 2$ whose coefficients satisfy a standard Lipschitz condition. More precisely, we first show a result on the existence and uniqueness of solutions, next we show the continuous dependence of solutions on the initial values and on the fractional exponent α. The second part of this paper is devoted to study the regularity in time for solutions of Caputo SFDE. As a consequence, we show that a solution of Caputo SFDE has a δ-Hölder continuous version for any $\delta \in (0, \alpha - \frac{1}{2})$. The main ingredient in the proof is to use a temporally weighted norm and Burkholder-Davis-Gundy inequality.

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Inverse 1-median problem with several cost norms

N. T. Kien[1] **and N. T. Hung**[1]

Abstract: This talk is about the inverse 1-median problem on trees under several cost functions. We first combine the rectilinear and Chebyshev norm into the term of sum of max or max of sum objective function. For the sum of max objective function, we develop a $O(M \log M)$ time algorithm, where M is the size of input. Meanwhile, we improve the complexity to linear time for the problem under the max of sum objective function. Finally, we discuss the problem under l_2-norm with a linear time algorithm.

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Tính liên thông của tập nghiệm của bài toán tối ưu véc-tơ đa thức lồi

N. M. Kim[1], **N. Q. Tuấn**[2] **và V. T. Hiếu**[3]

Tóm tắt: Trong báo cáo này, chúng tôi nghiên cứu bài toán tối ưu véc-tơ đa thức lồi, ở đó các hàm mục tiêu thỏa mãn một điều kiện chính quy theo nghĩa tiệm cận trên tập ràng buộc. Chúng tôi chỉ ra rằng các tập nghiệm Pareto chính thường, tập nghiệm Pareto, và tập nghiệm Pareto yếu của bài toán đó là liên thông.

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Openness, Hölder metric regularity and Hölder continuity properties of semialgebraic set-valued maps

J. H. Lee[1] **and T. S. Pham**[2]

Abstract: Given a semialgebraic set-valued map $F\colon \mathbb{R}^n \rightrightarrows \mathbb{R}^m$ with closed graph, we show that the map F is Hölder metrically subregular and that the following conditions are equivalent:

(i) *F is an open map from its domain into its range and the range of F is locally closed;*

(ii) *The map F is Hölder metrically regular;*

(iii) *The inverse map F^{-1} is pseudo-Hölder continuous;*

(iv) *The inverse map F^{-1} is lower pseudo-Hölder continuous.*

An application, via Robinson's normal map formulation, leads to the following result in the context of semialgebraic variational inequalities: *If the solution map (as a map of the parameter vector) is lower semicontinuous, then the solution map is finite-valued and pseudo-Hölder continuous.* In particular, we obtain a negative answer to a question mentioned in the paper of Dontchev and Rockafellar [Characterizations of strong regularity for variational inequalities over polyhedral convex sets, *SIAM J. Optim.* 4 (1996), 1087–1105].

As a byproduct, we show that for a (not necessarily semialgebraic) continuous single-valued map, the openness and the non-extremality are equivalent. This fact improves the main result of a paper by Pühn [Convexity and openness with linear rate, *J. Math. Anal. Appl.* 227 (1998), 382–395], which requires the convexity of the map in question.

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The multiple shooting approach for the convex rope problem

N. T. Le[1], **L. H. Trang**[2], **and P. T. An**[3]

Abstract: The convex rope problem, posed by Peshkin and Sanderson [*IEEE J. Robotics Automation*, 2 (1986), 53–58], is to find the counterclockwise and clockwise convex rope starting at the vertex a and ending at b of a simple polygon $\mathcal{P}$, where a is contained in the set of extreme vertices of the convex hull of $\mathcal{P}$ and b is visible from infinity, and the convex rope mentioned is the shortest path joining a and b that does not enter the interior of $\mathcal{P}$. In this talk, the convex rope is found approximately by the multiple shooting approach. The method consists of three factors: partition, collinear condition, and the update of shooting points. We show that the corresponding algorithm is globally convergent, i.e., the sequence of paths obtained by the algorithm converges to the optimal solution. The advantages of the algorithm and numerical experiments are also shown.

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An efficient algorithm for determining the connected orthogonal convex hulls

N. K. Linh[1], **P. T. An**[2], **and T. V. Hoai**[2]

Abstract: Orthogonal convexity (rectilinearity, or (x, y) convexity, or $x - y$ convexity) is one of the most extensively subjects studied in computational geometry and convex analysis because of its both theoretical and practical significance. Inspired by the idea of the Quickhull algorithm (finding the convex hull of a finite set of points was independently conducted by Eddy in 1977 and Bykat in 1978), we present a new efficient algorithm for determining the connected orthogonal convex hull of a finite set of points. The numerical experiments show that our algorithm runs faster than the existing ones (the algorithms introduced by Montuno and Fournier in 1982 and by An, Huyen and Le in 2020). We also show that the expected complexity of the algorithm is $O(n \log n)$ (the same as for sorting), where n is the number of points.

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Numerical method for stochastic non-colliding particle systems

N. H. Long[1]

Abstract: Stochastic particle systems appear in many areas such as mathematical physics, random matrix theory, and mathematical finance. The numerical approximation for these systems is still a challenging problem because the systems are modeled by high-dimensional stochastic differential equations with very irregular coefficients. Moreover, these systems usually have particular geometric structures which can hardly be captured by classical approximation methods. In this talk, we present some recent results on the numerical approximation for some classes of stochastic non-colliding particle systems such as Dyson's Brownian motions, Wishart processes, radial Dunlk processes...

This talk is based on several joint works with Dai Taguchi (Okayama University, Japan) and Luong Duc Trong (Hanoi National University of Education).

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Một số vấn đề về định lý hội tụ trung bình trong xấp xỉ nghiệm phương trình vi phân ngẫu nhiên với hệ số không chính qui

N. H. Long[1] **và L. Đ. Trọng**[2]

Tóm tắt: Bổ đề cơ bản trong xấp xỉ phương trình vi phân ngẫu nhiên đóng vai trò quan trọng lý thuyết xấp xỉ. Mục đích của các bổ đề dạng này là đưa ra tiêu chuẩn đánh giá sai số toàn cục của lược đồ xấp xỉ dựa vào sai số một bước. Kết quả đánh giá sai số trong L_2 được giới thiệu bởi G. Milstein (2013). Mục tiêu của báo cáo này nhằm giới thiệu kết quả tương tự cho sai số xấp xỉ trong L_1.

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Deterministic global optimization: Basic classes and solution methods

L. D. Muu[1]

Abstract: The talk consists of the two parts. In the first one we present some main classes of the global optimization problem, among them we focus on the concave minimization over a convex polyhedron, the linear program with additional reverse convex constraints, the DC, convex-concave and monotonic optimization. In the second part we talk about some basic solution-methods such as cutting plane, outer and inner approximation, branch-and-bound methods. At the end of the talk, we discuss the further extension and development of global optimization.

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An extended comparison principle for positive time-delay systems and its application

P. T. Nam[1], **L. Q. Thuan**[1], **and H. Trinh**[2]

Abstract: In this talk, we propose an extended comparison principle for linear continuoustime positive time-delay systems. Unlike the existing comparison principle, which uses a constant initial function for the similar system, instead, we propose a time-varying initial function in order to derive a more general solution comparison. Based on the comparison principle, we develop a novel computational method, which exploits more effectively the information of the initial value function, to derive a tighter exponential estimates for the state vector of a class of positive systems with bounded time-varying delays. Lastly, we consider a numerical example to illustrate the effectiveness of the developed method.

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A general model for the directional pseudo-subregularity of multifunctions

H. V. Ngai[1], N. H. Tron[2], N. V. Vu[3], and M. Théra[4,5]

Abstract: We shall discuss in this talk a new model which unifies several existing notions of directional metric regularity of multifunctions defined on Banach spaces in the literature. We introduce a general notion of the (γ, h)-directional pseudo-subregularity for a multifunction and establish several sufficient characterizations based on the notion of strong slope ensuring the validity of such a property. Further, we also consider an infinitesimal characterization for our proposed model using abstract coderivative of multifunctions.

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A strong convergence theorem for an iterative method for solving the multiple-sets split feasibility problem in Hilbert spaces

N. T. Nghia[1] **and N. T. T. Thuy**[2]

Abstract: There are many iterative methods for solving the multiple-sets split feasibility problem involving step sizes that depend on the norm of a bounded linear operator $\mathcal{F}$. The implementation of such algorithms is usually difficult to handle with because one haas to compute the norm of the operator $\mathcal{F}$. In this talk, we introduce a new iterative algorithm for approximating a solution of a class of multiple-sets split feasibility problem without prior knowledge of operator norms. Strong convergence of the iterative process is proved. Then, we recapitulate the two methods for this class of problem which were given by Nguyen Buong [Iterative algorithms for the multiple-sets split feasibility problem in Hilbert spaces, *Numer. Algor.* 76 (2017), 783–798] and by Tran Viet Anh [A parallel method for variational inequalities with the multiple-sets split feasibility problem constraints, *J. Fixed Point Theory Appl.* 19 (2017), 2681–2696]. A numerical example is given to illustrate the proposed iterative algorithm and compare it with the methods of Buong and Anh.

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Network model and risk estimation in epidemic problem

L. C. Ngoc[1], V. T. Hue[2], and N. T. Dung[3]

Abstract: The COVID-19 outbreak in Vietnam in the late January 2021 period poses many challenges. The two most important problems are early detection and localization of epidemic spots with a high risk of the outbreak. To deal with the problem, we introduce an effective approach through the application of graph theory. The graph has represented the map of an area, with two adjacent vertices are two adjacent communes on the map. Hence, we simulate the movement of patients as random walks on the graph to estimate the risk of outbreaking each commune. In this talk, we select Hanoi city as the target of the research. Hanoi city with more than 8 million people spread over 582 communes, combined with the complex population factor makes Hanoi very vulnerable and difficult to control.

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No-gap second-order optimality conditions for a non-smooth semilinear elliptic optimal control problem

V. H. Nhu[1]

Abstract: This talk is concerned with second-order necessary and sufficient optimality conditions for optimal control of a non-smooth semilinear elliptic partial differential equation in which the nonlinearity is the non-smooth max-function and thus the associated control-to-state operator is in general not Gâteaux-differentiable. In addition to standing assumptions, two main hypotheses are imposed. The first one is the Gâteaux-differentiability at the considered control of the objective functional and it is precisely characterized by the vanishing of an adjoint state on the set of all zeros of the corresponding state. The second one is a structural assumption on the sets of all points at which the values of the interested state are 'close' to the non-differentiability point of the max-function. We then derive a 'no-gap' theory of second-order optimality conditions in terms of a second-order generalized derivative of the cost functional, i.e., for which the only change between necessary and sufficient second-order optimality conditions is between a strict and non strict inequality.

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Fixed point theorems of Kannan type contractive mappings in strong b-metric spaces

H. T. Phuong[1], B. T. Hung[1], and D. T. Hieu[3]

Abstract: We establish fixed point theorems of Kannan contractive mappings and Kannan type contractive mappings in strong b-metric spaces. Our results extend the results of Kannan (R. Kannan, *Some results on fixed points*. Bull. Calcutta Math. Soc. 60 (1968), 71–76) and Górcnicki (J. Górcnicki, *Fixed point theorems for Kannan type mappings*. J. Fixed Point Theory Appl. 19 (2017), 2145–2152). In addition, by using our results, we obtain the solution existence and uniqueness of ordinary differential equations with initial value conditions.

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Symplectic eigenvalue problem via trace minimization and Riemannian optimization

N. T. Son[1], **P.-A. Absil**[2], **B. Gao**[2], **and T. Stykel**[3]

Abstract: We address the problem of computing the smallest symplectic eigenvalues and the corresponding eigenvectors of symmetric positive-definite matrices in the sense of Williamson's theorem. It is formulated as minimizing a trace cost function over the symplectic Stiefel manifold. We first investigate various theoretical aspects of this optimization problem such as characterizing the sets of critical points, saddle points, and global minimizers as well as proving that non-global local minimizers do not exist. Based on our recent results on constructing Riemannian structures on the symplectic Stiefel manifold and the associated optimization algorithms, we then propose solving the symplectic eigenvalue problem in the framework of Riemannian optimization. Moreover, a connection of the sought solution with the eigenvalues of a special class of Hamiltonian matrices is discussed. Numerical examples are presented.

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Ước lượng khoảng cách biến phân toàn phần giữa các biến ngẫu nhiên

T. C. Sơn[1], **N. T. Dũng**[2] **và L. Q. Dũng**[3]

Tóm tắt: Báo cáo giới thiệu sơ lược về khoảng cách biến phân giữa các biến ngẫu nhiên, giải tích Malliavin, và phương pháp Stein. Từ đó, các tác giả sử dụng kỹ thuật của giải tích Malliavin để ước lượng tốc độ hội tụ theo khoảng cách biến phân toàn phần của xấp xỉ Smoluchowski-Kramers của một lớp các phương trình vi phân ngẫu nhiên. Bên cạnh đó, các tác giả sử dụng phương pháp Stein để đưa ra một xấp xỉ cho khoảng cách biến phân toàn phần giữa một thống kê và phân bố chuẩn tắc.

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Tamed-adaptive Euler-Maruyama approximation for SDEs with locally lipschitz continuous drift and locally Hölder continuous diffusion coefficients

K. T. Thuy[1], **N. H. Long**[1], **and D. T. Trong**[1]

Abstract: We propose a tamed-adaptive Euler-Maruyama approximation scheme for stochastic differential equations with locally Lipschitz continuous, polynomial growth drift, and locally Hölder continuous, polynomial growth diffusion coefficients. We consider the strong convergence and stability of the new scheme. In particular, we show that under some sufficient conditions for the stability of the exact solution, the tamed-adaptive scheme converges strongly in any infinite time interval.

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A hybrid method for solving variational inequalities over the common fixed point sets of infinite families of nonexpansive mappings in Banach spaces

N. T. T. Thuy[1] **and P. T. Hieu**[2]

Abstract: We introduce a hybrid method, a combination of the steepest-decent method and the Krasnosel'skii-Mann one, for solving a variational inequality over the set of common fixed points of an infinite family of nonexpansive mappings in Banach spaces under two different conditions on the space, without imposing the sequential weak continuity of the normalized duality mapping. Namely, the space can be either a uniformly smooth Banach space or a reflexive and strictly convex one with a uniformly Gâteaux differentiable norm. The method is an improvement and extension of some known ones. We also give a numerical example to illustrate the convergence of the proposed method.

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New criteria for exponential stability of general functional differential equations

C. T. Tinh[1]

Abstract: In this talk, we present some scalar criteria for the exponential stability of general functional differential equations. Both delay-independent and delay-dependent stability criteria are provided. The stability conditions are quite simple, easy to use. Furthermore, a discussion of the obtained results is given.

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Nonlinear metric regularity on fixed sets

N. H. Tron[1], **D. N. Han**[2], **and H. V. Ngai**[3]

Abstract: The aim of this talk is to present some new models of nonlinear regularity on fixed sets of set-valued mappings defined on complete metric spaces. Slope and coderivative characterizations of these models are given. The stability of the Milyutin regularity is investigated when the initial set-valued mapping is perturbed by a suitable Lipschitz single-valued map.

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An approach to characterize ϵ-solution sets of convex programs

N. V. Tuyen[1], **C. F. Wen**[2], **and T. Q. Son**[3]

Abstract: In this talk, we propose an approach to characterize ϵ-solution sets of convex programs with a given $\epsilon > 0$. The results are divided into two parts. The first one is devoted to establishing the expressions of ϵ-solution sets of a class of convex infinite programs. The representation is given based on the study of relationships among the following three sets: the set of Lagrange multipliers corresponding to a given ϵ-solution, the set of ϵ-solutions of the dual problem corresponding, and the set of ϵ-Kuhn-Tucker vectors associated with the problem in consideration. The second one is devoted to some special cases: the ϵ-solution sets of convex programs that have set constraints and the almost ϵ-solution sets of convex programs that have finite convex constraints. Several examples are given.

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Łojasiewicz gradient inequality and local Hölderian error bound in a certain class of smooth functions

H. H. Vui[1]

Abstract: We define a class of smooth functions and show that if f belongs to this class, $f(0) = 0$, $\nabla f(0) = 0$, and f satisfies the Kouchnirenko non-degenerate condition w.r.t. its Newton polyhedron, then f admits the Łojasiewicz gradient inequality and the sublevel set $[f \leq 0]$ admits a local Hölderian error bound. The exponents in these inequalities can be estimated by quantities depending only on the Newton polyhedron of f. The key in our analysis is a toric resolution of singularities in this class of smooth functions.

This is a joint work with Ha Minh Lam (Institute of Mathematics, Vietnam Academy of Science and Technology).

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