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TÓM TẮT BÁO CÁO

Multiple shooting approach for solving some geometric shortest path problems

P. T. An[1], N. N. Hai[2], T. V. Hoai[3], and L. H. Trang[4]

Abstract: We present a new approach called multiple shooting for computing shortest paths from a point p to a point q in a geometric domain.

Firstly, the domain is divided into subdomains by suitable cutting segments/slices between p and q, a shooting point is initialized on each cutting segment/slice. The shortest paths between two consecutive shooting points on every subdomain are determined and then combined into a path from p to q. Secondly, since the first segments of these shortest paths incident at each shooting point are collinear, a straight condition is constructed to check if the obtained path is an approximate shortest path. Finally, a update of the shooting points is performed due to the straight condition such that the length of the path formed by shooting points is non-increasing. We then obtain an approximate shortest path. Our method is similar to the geometrical idea of the well-known multiple shooting method for solving the ODE-boundary value problems.

The approach can be applied for some variants of geometric shortest path problems such as: finding shortest path between two points inside a simple polygon and shortest path between two points on the surface of a convex polytope. In this talk, in order to illustrate how the method works, we consider a variant of geometric shortest path problem in which we need to find a *shortest descending path* between two points on a convex terrain.

The algorithms are implemented in C++ using CGAL. Numerical experiments compared with the Agarwal et al.'s algorithm on convex polytopes show that the multiple shooting approach is better on the accurate construction of the shortest path.

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Control problems of partial differential equations

C. T. Anh[1]

Abstract: A control system is a dynamical system on which one can act by using suitable controls. There are three common problems that appear when studying a control system.

- The optimal control problem: Minimize a criterion depending on the observation of the state and on the control.
- The controllability problem: Is it possible to reach a desired target from a given starting point?
- The stabilization problem: Study the existence and construction of a feedback law which stabilizes an unstable equilibrium.

In this talk we survey some methods to handle these problems when the control systems are modeled by evolutionary partial differential equations of parabolic type. This class of PDEs consists of many important equations, such as the heat equation and Navier-Stokes equations, etc.

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Optimal control problems of the variable density Boussinesq system

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Abstract: We consider some optimal control problems governed by the variable density Boussines system, a system of variable density incompressible Navier-Stokes equations for the velocity field couped with a variable density convection-diffusion equation for the temperature. We prove the existence of solutions as well as the first-order necessary optimality conditions for these problems.

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Lipschitz stability in inverse source problems and null controllability for the parabolic Grushin operator with a singular potential by the Carleman estimate

C. T. Anh[1] **and V. M. Toi**[2]

Abstract: Consider parabolic equations involving the Grushin operator with an inverse-square potential in multi-dimensional domains. We prove the null controllability in large time and the Lipschitz stability in the inverse source problem for such operator with locally distributed measurements. To overcome the essential difficulty caused by the degeneracy and the singularity of the operator, we exploit the Fourier decomposition method that relies on a new Carleman estimate and a suitable dissipation speed.

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Sensitivity analysis for approximate solutions mappings of weak vector equilibrium problems

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Abstract: In this article, we consider parametric weak vector equilibrium problems in normed spaces. Sufficient conditions for Hölder continuity of approximate solutions mappings where they are set-valued are established. As applications of these results, the Hölder continuity of the approximate solutions mappings for vector optimization problems and vector variational inequalities are derived at the end of the paper. Our results are new and include the existing ones in the literature.

Keywords: Hölder continuity, approximate solutions, equilibrium problems, variational inequalities, optimization problems

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Well-posedness for lexicographic vector equilibrium problems

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Abstract: We consider lexicographic vector equilibrium problems in metric spaces. Sufficient conditions for a family of such problems to be (uniquely) well-posed at the reference point are established. Many examples are provided to ensure the essentialness of the imposed assumptions. As an application, we derive several results on well-posedness for a class of variational inequalities.

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On Hölder continuity of approximate solutions to parametric equilibrium problems

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Abstract: We establish verifiable sufficient conditions for Hölder continuity of approximate solutions to parametric equilibrium problems, when solutions may be not unique. Many examples are provided to illustrate the need of considering approximate solutions instead of exact solutions and the essentialness of the imposed assumptions. As applications, we derive this Hölder continuity for constrained minimization, variational inequalities and fixed point problems.

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Thuật toán Ergodic cho bài toán cân bằng trên tập điểm bất động của ánh xạ không giãn

P. N. Anh[1] **và T. N. Hải**[2]

Tóm tắt: Báo cáo trình bày thuật toán Ergodic áp dụng cho bài toán cân bằng trên tập điểm bất động của ánh xạ không giãn. Đây chính là mở rộng của bài toán cân bằng thông thường. Cho C là tập lồi đóng khác rỗng trong $\mathcal{R}^n$, $f : C \times C \to \mathcal{R}$ là song hàm cân bằng thỏa mãn $f(x, x) = 0\ \forall x \in C$. Bài toán cân bằng của hàm f trên tập C được phát biểu như sau: tìm $x^* \in C$ sao cho $f(x^*, y) \geq 0\ \forall y \in C$, ký hiệu là bài toán $EP(f, C)$.

Giả sử $T : C \to C$ là một ánh xạ không giãn. Ký hiệu Fix(T) là tập điểm bất động của T. Trong bài báo cáo, ta quan tâm tới bài toán: tìm $x^* \in Fix(T)$ sao cho $f(x^*, y) \geq 0$ $\forall y \in Fix(T)$, ký hiệu $EP(f, Fix(T))$. Trong trường hợp tổng quát, $EP(f, fix(T))$ có thể đưa về bài toán cân bằng $EP(f, C)$ bằng cách chọn ánh xạ T thích hợp. Bài toán cân bằng trên tập điểm bất động xuất phát từ mô hình thực tế: bài toán điều khiển công suất cho mạng điện thoại CDMA. Chúng tôi đề xuất thuật toán Ergodic để giải bài toán $EP(f, fix(T))$, Với giả thiết về tính đơn điệu của song hàm f, chúng tôi đã chứng minh được tính hội tụ của thuật toán. Trong phần cuối của bài báo cáo, chúng tôi có trình bày kết quả số minh họa.

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Fixed point solution methods for solving equilibrium problems

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Abstract: In this paper, we propose new iteration methods for finding a common point of the solution set of a pseudomonotone equilibrium problem and the solution set of a monotone equilibrium problem. The methods are based on both the extragradient-type method and the viscosity approximation method. We obtain weak convergence theorems for the sequences generated by these methods in a real Hilbert space.

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A fixed point scheme for nonexpansive mappings, variational inequalities and equilibrium problems

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Abstract: The purpose of this paper is to introduce a new iteration scheme and prove a strong convergence theorem for finding the common element of the fixed point set of a nonexpansive mapping, the solution set of variational inequalities and the solution set of equilibrium problems. Under certain conditions on parameters, we show that the iterative sequences generated by the scheme strongly converge to the common element in a real Hilbert space.

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Regularization Newton-Kantorovich iterative method for nonlinear monotone ill-posed equations in Banach spaces

N. Buong[1] **and N. D. Nguyen**[2]

Abstract: In this report, in order to solve nonlinear ill-posed operator equations involving monotone mappings on a real and reflexive Banach space, we prove a strongly convergent theorem for regularization Newton-Kantorovich iterative method, by using a linear and strongly monotone mapping as regularization term, instead of the generalized duality mapping. In our results, we have only to solve linear equation in each iterative step.

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Coderivative characterizations of maximal monotonicity for set-valued mapping

N. H. Chieu[1]

Abstract: In this talk, we will present some coderivative characterizations of maximal monotone set-valued mappings, which seem to be the first infinitesimal characterizations of maximal monotonicity outside the single-valued case. We will also present second-order necessary and sufficient conditions for lower-$\mathcal{C}^2$ functions to be convex and strongly convex. Examples will be provided to illustrate the obtained results and the imposed assumptions.

This talk is based on the joint paper under the same title written by N. H. Chieu, G. M. Lee, B. S. Mordukhovich and T. T. A. Nghia.

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Tập mờ bức tranh - hướng mới trong lý thuyết tập mờ và hệ mờ

B. C. Cường[1]

Tóm tắt: Năm 2013 chúng tôi đưa ra khái niệm mới: tập mờ bức tranh (Picture Fuzzy Sets) - trực tiếp suy rộng khái niệm tập mờ của Zadeh (1965) và khái niệm tập mờ trực cảm của Antanassov (1983). Báo cáo sẽ :

- Giới thiệu một số kết quả mới về các toán tử trong tập mờ bức tranh, tập mờ bức tranh mềm.
- Vài lớp toán tử logic mờ.
- Giới thiệu một vài vấn đề mở nên nghiên cứu tiếp.

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A unified approach to optimality for some classes of robust optimization problems

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Abstract: In this report, we first present some versions of robust Farkas lemma for uncertain systems involving composite functions . These new results are then used to study a variety of classes of robust optimization problems including robust linear problems, robust convex problems, robust semi-infinite/infinite convex problems. Optimality conditions for these classes of problems are given.

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Asymptotic versions of Farkas lemma and Hahn-Banach theorem

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Abstract: In this report we establish new versions of Farkas lemma for systems which are convex with respect to (w.r.t.) a convex cone and convex w.r.t. an extended sublinear function. These versions hold in the limit forms (and the name "asymptotic" Farkas lemma). We show that these versions yield versions of approximate Hahn-Banach theorem, approximate Hahn-Banach-Lagrange theorem, and of approximate sandwich theorem.

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Ứng dụng điều khiển tối ưu và tính toán hiệu năng cao vào thủy lực, một số thành tựu và tồn tại

N. T. Đôn[1], **N. V. Quế**[2], **T. Q. Hưng**[3], **và N. H. Phong**[1]

Tóm tắt: Điều khiển tối ưu đang được nghiên cứu ứng dụng trong nhiều lĩnh vực và đang đem lại nhiều lợi ích to lớn. Đối với lĩnh vực tính toán mô phỏng dòng chảy thủy văn thủy lợi, xa hơn là lũ lụt, phương pháp đồng hóa số liệu, một dạng điều khiển tối ưu, đã được nghiên cứu và từng bước bắt đầu có các ứng dụng thực tế. So với các phương pháp tác nghiệp truyền thống khac về độ chính xác và trong một vài bài toán quan trọng, phương pháp đồng hóa số liệu tỏ ra hiệu quả vượt trội. Tuy nhiên nếu so sánh tỉ số giữa độ chính xác và độ tiện lợi trong các bài toán phổ thông, phương pháp này chưa chắc hơn, bởi vì phương pháp đòi hỏi công nghệ tính toán quá cao. Ngoài ra phương pháp này cũng gặp vấn đề cực trị toàn cực, cực trị địa phương và khi dòng chảy xuất hiện sốc, tức là khi hàm mục tiêu mất tính trơn, hoặc tính liên tục.

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Solution-existence and algorithms with their convergence rate for strongly pseudomonotone equilibrium problems

P. M. Đức[1], **L. D. Mưu**[2], **and N. V. Quý**[3]

Abstract: The aim of this paper is first to show the solution existence, then to use the auxiliary problem principle and projection to develop three algorithms for solving strongly pseudomonotone equilibrium problem (EP) and to investigate their convergence rate. Thanks to strong pseudomonotonicity, the proposed algorithms require, at each iteration, to solve only one strongly convex program, rather than two programs as in an extragradient algorithm for monotone and pseudomonotone equilibrium problems. Moreover, linear convergence is obtained for the first algorithm, and in the last algorithm, the moving direction does not take only the objective bifunction, but also the feasible domain into account.

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Determination of the initial condition in parabolic equations from interior integral observations

D. N. Hao[1] **and N. T. N. Oanh**[2]

Abstract: In this paper, we study the problem of determining the initial condition in parabolic equations with time-dependent coefficients from interior integral observations. Our approach is different from the existing problem setting: for determining the initial condition one has to assume the data available in the whole physical domain at the final moment, or in a subset of the physical domain during a certain time interval. We propose a variational method in combination with Tikhonov regularization for solving the problem and test the algorithm on computer to show its efficiency.

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Parallel hybrid extragradient methods for pseudomonotone equilibrium problems and nonexpansive mappings

D. V. Hieu[1], **L. D. Muu**[2], **and P. K. Anh**[3]

Abstract: In this paper we propose and analyze three parallel hybrid extragradient methods for finding a common element of the set of solutions of equilibrium problems involving pseudomonotone bifunctions $f_i,\ i = 1, \ldots, N$ and the set of fixed points of nonexpansive mappings $S_j,\ j = 1, \ldots, M$ in a real Hilbert space, namely:

- a parallel hybrid Mann-extragradient method;
- a parallel hybrid Halpern-extragradient method, and
- a parallel hybrid iteration-extragradient method.

Based on parallel computation we can reduce the overall computational effort under widely used conditions on the bifunctions $f_i,\ i = 1, \ldots, N$ and the mappings $S_j,\ j = 1, \ldots, M$. A simple numerical example is given to illustrate the proposed parallel algorithms.

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Linear perturbations of quasiconvex functions and convexity

P. D. Khanh[1] **and M. Lassonde**[2]

Abstract: We show that a radially continuous function $f : C \to \mathbb{R}$ on a convex subset C of a vector space E is convex if for some linear form c^* not constant on C, the function $f + \lambda c^*$ is quasiconvex for all $\lambda \in \mathbb{R}$.

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On the properties of solutions of the perturbed evolution equations and applications

L. P. Linh[1] **and D. D. Chau**[2]

Abstract: In a Banach space X, we consider differential equation:

$$\frac{dx}{dt} = Ax + G(t, x) \qquad (1)$$

where $A : D(A) \to X$ is the linear operator. In many cases A can be linear differential operator $L : f \to Lf$ is defined by

$$Lf := \sum_{\alpha} a_\alpha(x) D^\alpha f.$$

By evolution semigroup method, the study of properties of solutions of partial differential equations can be put on the study of asymptotic behavior of solutions of perturbed abstract evolution equations in Banach space. The received results can be applied in many application models is described in the form of equation (1). In this paper we present some results were obtained in study of the asymptotic behavior of evolution equations and applied to the age - dependent population models.

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Half-explicit Runge-Kutta-Chebyshev methods for stiff DAE of index 1 and 2

V. H. Linh[1] **and N. D. Trường**[2]

Abstract: Numerical integration of differential-algebraic equations (DAEs) is a fairly well-known subject in numerical analysis. Many numerical methods have been studied for solving DAEs of low index. However, efficient numerical schemes for solving large-sized and stiff DAEs still need to be developed. In this talk, the authors propose efficient half-explicit Runge-Kutta-Chebyshev methods (HE-RKC) for solving stiff DAEs of index 1 and 2. The main idea of the methods is to combine a Runge-Kutta-Chebyshev scheme for the differential part and an implicit scheme for the algebraic part. So, we can exploit the structure of the considered DAEs and the convergence and stability properties of the RKC methods. Some numerical experiments are given for illustration.

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Về bài toán cân bằng theo bất đẳng thức Nikaido-Isoda-Fan

L. D. Mưu[1]

Tóm tắt: Giới thiệu một cách tổng quan những vấn đề chính liên quan đến bài toán cân bằng được mô tả theo bất đẳng thức Nikaido-Isoda-KyFan. Cụ thể:

1. Bài toán cân bằng và các trường hợp riêng;
2. Những kết quả chính về sự tồn tại nghiệm;
3. Các phương pháp giải cơ bản;
4. Vấn đề hiệu chỉnh;
5. Một số hướng mở rộng.

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Nonliear model predictive control using multi-parametric programming and exact linearization

D. P. Nam[1], **N. D. Phuoc**[1], **and N. D. Hoa**[1]

Abstract: Model predictive control (MPC) has been widely adopted by industry to address optimization problems with input and output constraints. In [1], a nonlinear model predictive control (NMPC) strategy requires the formulation of an optimization problem and with linear models the MPC problem is typically a quadratic or linear program, which is known to be convex and for which there exists a variety of numerical methods and software. While the numerical complexity of linear MPC may be a reasonable challenge with powerful computers being available, there is no doubt that NMPC is limited in its industrial impact due to the challenges of guaranteeing a global (or at least sufficiently good) solution to the resulting nonlinear optimization problem within the real-time requirements [1]. In this report, we will try to combine multi-parametric programming and exact linearization to overcome this obstacle:

- The exact linearization concerns the synthesis of nonlinear controllers for multivariable nonlinear processes that make the closed-loop system linear in an input/output sense with necessary and sufficient conditions for input/output linearizability via static state feedback are derived.
- The solution of mp-QP problems can be approached by employing the principles of multi-parametric nonlinear programming and in particular the first-order Karush-Kuhn-Tucker (KKT) optimality conditions [1]:
  - From an initial vector $x = x_0$ inside the polyhedral set X of parameters is needed, the QP problem is solved in order to obtain the corresponding optimal solution z_0;
  - Hence, we consider a combination of active constraints to obtain the the set of all vectors $x(CR_0)$ for which such a combination is active at the optimum.
  - Then, the optimal z and the associated vector of Lagrange multipliers λ uniquely defined linear functions of x over CR_0.
  - The algorithm continues with the division of the rest of the parameter space $X - CR_0$.

References

1. Alexandra Grancharova, Arne Hohansen: *Explicit Nonlinear Model Predictive Control - Theory and Applications.* Springer, 2012.

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Tính ổn định của hệ chuyển mạch tuyến tính suy biến trên time scales

L. V. Ngọc[1]

Tóm tắt: Bài toán ổn định của hệ chuyển mạch được rất nhiều các nhà khoa học quan tâm trên hai phương diện liên tục và rời rạc bởi nó chỉ ra rằng trong hệ chuyển mạch mặc dù tất cả các hệ con ổn định nhưng hệ chuyển mạch vẫn không ổn định, hoặc hệ có tất cả các hệ con ổn định thì hệ chuyển mạch ổn định nhưng tùy thuộc vào tín hiệu chuyển mạch, hoặc các hệ con không ổn định nhưng có quy luật nào đó hệ chuyển mạch vẫn ổn định, hoặc hệ chuyển mạch ổn định tiệm cận với tín hiệu chuyển mạch tùy ý khi và chỉ khi các hệ con có chung một hàm Lyapunov thích hợp.

Nội dung báo cáo trình bày lý thuyết time scales, tính ổn định của hệ chuyển mạch tuyến tính trên time scales. Đóng góp của báo cáo xây dựng được hàm Lyapunov và các điều kiện cho hệ chuyển mạch tuyến tính suy biến dạng $E_{s(t)}x^{\Delta}(t) = A_{s(t)}x(t)$ ổn định trên time scales.

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On exponential stability of linear non-autonomous functional differential equations

P. H. A. Ngoc[1] **and C. T. Tinh**[2]

Abstract: Using a novel approach, we first give some new explicit criteria for exponential stability of general linear *non-autonomous* functional differential equations of the form

$$\dot{x}(t) = A(t)x(t) + \int_{-h}^{0} d[\eta(t,\theta)]x(t+\theta), \quad t \geq \sigma.$$

Then we offer an explicit robust stability bound for the above system subject to time-varying structured perturbations. A brief discussion of the obtained results and two illustrative examples are presented.

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Application of computational and mathematical modeling to solve important biological questions in the 21^{st} century

L. K. Nguyen[1]

Abstract: The last decade has witnessed an unprecedented explosion of biological knowledge and large data sets acquired for many signalling processes at the cellular level, largely due to the development of sophisticated and high-throughput biochemical techniques in proteomics and other -omics. The huge complexity hampers our ability to interpret and predict the regulation of the network as a whole, which is essential to better understand the signalling and its role in diseases such as cancer. To unravel this complexity and obtain a systems-level understanding of network signalling, systems biology approaches employing quantitative frameworks in forms of mathematical and computational models are emerging as promising solutions. These mathematical models provide a platform for the description, prediction and understanding of the various regulatory mechanisms in a quantitative and integrative way. In this talk, I will present a number of examples where we employed computational modeling in connection with biological experiments to understand some of the key questions in cancer signaling network (Nguyen, Dobrzynski, Fey, and Kholodenko, 2014; Nguyen, Kolch, and Kholodenko, 2013; Nguyen, Matallanas, Romano, Kholodenko, and Kolch, 2015; Nguyen et al., 2011; Romano et al., 2014). Having a good supply of young scientists with strong mathematical, computational and computing backgrounds, I will argue that Vietnam as a country could start making concrete contributions to this field where mathematics is applied to solve important biological problems in the 21^{st} century.

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Variational analysis and regularity of the minimum time function for differential inclusions

L. V. Nguyen[1]

Abstract: We study the time optimal control problem for differential inclusions with a general closed target. We first give the representation of the proximal horizontal subgradients of the minimum time function $\mathcal{T}$ and then, together with the representation of the proximal subgradients, we obtain some relationships between the normal cones to the sublevel of $\mathcal{T}$ and the normal cones to its epigraph. The relationships allow us to get the propagation of the proximal subdifferential as well as of the proximal horizontal subdifferential of $\mathcal{T}$ along optimal trajectories. Finally, we show, under suitable assumptions, that the epigraph of $\mathcal{T}$ is φ-convex near the target. This is the first nonlinear φ-convexity result valid in any dimension.

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Second-order optimality conditions for a semilinear elliptic optimal control problem ith a pure pointwise state constraint and finitely many mixed pointwise control-state constraints

V. H. Nhu[1] **and N. H. Son**[2]

Abstract: This report gives the second-order necessary and sufficient optimality conditions for a semilinear elliptic optimal control problem with many mixed pointwise control-state constraints and a pure pointwise state constraint. The results of the second-order necessary optimality conditions are based on the ones in programming problems in which we can estimate the "sigma-term" for mixed pointwise control-state contraints. The second-order sufficient optimality conditions are obtained by using some standard techniques.

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Một cách tiếp cận mới cho vấn đề chọn tâm trong 2D giải phương trình Poisson bằng phương pháp RBF-FD

H. X. Phú[1] **và Đ. T. Oanh**[2]

Tóm tắt: Trong báo cáo này chúng tôi thảo luận một cách chọn tâm mới trong không gian 2D, bộ tâm được chọn sẽ sử dụng nội suy để tính véc tơ trọng số cho phương pháp RBF-FD giải phương trình Poisson. Mục đích của cách tiếp cận này là chất lượng nội suy hàm RBF tăng lên đồng thời giảm chi phí trong qua trình chọn tâm và đặc biệt, cách tiếp cận này có thể thực hiện một cách hiệu quả trên sự phân bố tâm bất kỳ và cấu trúc hình học của miền phức tạp.

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On separation theorems and sets having the separation property

H. T. Phung[1]

Abstract: A convex subset of a normed space is said to have the (strong) separation property if it can be (strongly) separated from every other disjoint closed convex set by a closed hyperplane.

It is well known that, every weakly compact convex set has the strong separation property, and every convex set with a nonempty interior has the separation property. Some further features of subsets having (strong) separation property have been also established in the literature. Especially, in the case of Hilbert spaces, we have the interesting result below.

Theorem 1 (E. Ernst, M. Théra, 2005)**.** *An unbounded closed convex subset C of a Hilbert space has the separation property if and only if, its affine hull,* $\mathrm{aff(C)}$*, is a finite-codimensional closed affine subspace, and the relative interior,* $\mathrm{riC} := \mathrm{Int}_{\mathrm{aff(C)}}\mathrm{C}$*, is nonempty.*

In this talk, by using auxiliary conditions on the support functions, we shall establish some new results on the separation of convex sets, and then develop some features of subsets having the strong separation property in normed linear spaces.

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Coderivatives of normal cone mappings and applications

N. T. Qui[1]

Abstract: The notion of *generalized equation*, that is an inclusion involving a single-valued function f and a normal cone mapping $N(\cdot\,;C)$ to a constraint set C in the form

$$0 \in f(x) + N(x;C),$$

was introduced by Stephen M. Robinson in 1979. Generalized equations are convenient tools for formulating problems in complementarity, mathematical programming, and variational inequalities. Generalized differentiability properties of normal cone mappings allow one to obtain useful information about solution stability of parametric generalized equations as well as solution stability of problems that refer to parametric generalized equations. In this presentation, we give formulas for computing the Fréchet and Mordukhovich coderivatives of normal cone mappings to constraint sets with respect to perturbed polyhedral convex sets, perturbed Euclidean balls, perturbed smooth-boundary sets. The obtained coderivative formulas are applied to establish necessary and sufficient conditions for the local Lipschitz-like property and metric regularity of the solution maps of parametric generalized equations as well as the solution maps of parametric variational inequalities, the Karush-Kuhn-Tucker point set maps of trust-region subproblems in trust-region methods.

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Some results on fuzzy partial hyperbolic functional differential equations with generalized Hukuhara derivatives

N. T. K. Son[1], **H. T. T. Tam**[2], **and H. V. Long**[3]

Abstract: In this talk, we present some new results on fuzzy partial hyperbolic functional differential equations. We combine two aspects fuzzy mathematics and functional PDEs to get fuzzy partial hyperbolic functional differential equations in the sense of generalized Hukuhara-differentiability. By this setting, the global existence of four solutions, each one corresponding to a different type of differentiability, is investigated in the whole infinite domain $[a, \infty) \times [b, \infty)$. Some concrete examples was showed to demonstrate for our results. In which, we use the same strategy as Buckley-Feuring to gain the BF fuzzy solutions from fuzzyfying deterministic solutions. Furthermore, by using the continuity of Zadeh extension principle combined with method of steps, we construct a useful procedure for calculating solutions of fuzzy functional PDEs.

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Some types of sets which are not sequentially normally compact

V. X. Truong[1] **and N. D. Yen**[2]

Abstract: Sequential normal compactness (SNC for short) is a crucial concept in variational analysis. This paper investigates some specific cases in which a set does not have the SNC property. Among other things, we re-analyze the example suggested by J.M. Borwein, S. Fitzpatrick and R. Girgensohn (2003) which has a non-closed Mordukhovich normal cone. The difference between the Bouligand-Severi tangent cone and the weak Bouligand-Severi tangent cone are also considered.

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Finite-time H_∞ control for linear discrete-time delay systems with norm-bounded disturbances

L. A. Tuấn[1] **and V. N. Phát**[2]

Abstract: This talk deals with the problem of finite-time H_∞ control for linear discrete-time delay systems. The system under consideration is subject to interval time-varying delay and norm-bounded disturbances. First, new sufficient conditions are given to ensure the finite-time H_∞ boundedness of the system. Next, based on this result, the state feedback controller is designed to guarantee the resulting closed-loop system is finite-time H_∞ bounded. The delay-dependent sufficient conditions are formulated in terms of linear matrix inequalities. Finally, numerical examples are constructed to illustrate the effectiveness of our theoretical results.

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Some characterizations of solution sets of vector optimization problems

N. V. Tuyen[1]

Abstract: In this talk we establish a necessary and sufficient conditions for optimal solutions to vector optimization problems, where the optimality notion is undertood in the sense of generalized order from Definition 5.53 in the book "Variational Analysis and Generalized Differentiation II: Applications" by B.S. Mordukhovich. This notion is directly induced by the concept of local extremal points for systems of sets and covers all the traditional notions of optimality in vector optimization. Moreover, some characterizations of the closedness and the connectivity of solution sets are also given. Many examples are provided to illustrate the obtained results.

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