964-49-200

Fernando Pereira* (flp@fe.up.pt), DEEC, FEUP, Porto University, Rua Dr. Roberto Frias Porto, Portugal, and **Geraldo da Silva** (gsilva@dcce.ibilce.unesp.br), DCCS, Universidade Estadual Paulista, C. P. 136 S. Jose Rio Preto-SP, Brazil. *Necessary Conditions of Optimality for Impulsive Control Problems with State Constraints.*

A proper concept of control process and necessary conditions of optimality are provided for a problem of the form

$$\begin{array}{lll} (P) & \text{Minimize} & h(x(0), x(1)) \\ & \text{subject to} & dx(t) \in F(t, x(t))dt + G(t, x(t))\mu(dt) \qquad \forall t \in [0,1] \\ & & (x(0), x(1)) \in C, \quad \mu \in K \quad \text{and} \quad l(t, x(t)) \leq 0 \quad \forall t \in [0,1] \end{array}$$

The last measure inclusion means $\mu \in C^*([0,1]; K)$, the dual space of continuous functions from $[0,1]$ to K. The differential inclusion is a short notation for the fact that x evolves due to the contribution of an absolutely continuous component x_{ac} and a singular component x_s. This concept of control process fulfills the requirements underlying the well-posedness of the dynamic optimization problem as well as the "robustness" required for the derivation of necessary conditions of optimality. These conditions are obtained by taking a limit of those for an appropriate sequence of auxiliary "standard" optimal control problems approximating the original one. An example illustrating the nature of the new optimality conditions is provided. (Received February 05, 2001)

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Grant N. Galbraith* (gng@math.ucdavis.edu), Department of Mathematics, University of California, Davis, 483 Kerr Hall, Davis, CA. *Sub-Lipschitz Mappings and Connections to Optimal Control and the Hamilton-Jacobi Equation.*

Assume we have an optimal control problem for which the velocities are constrained via a differential inclusion arising from a set-valued mapping F. A typical assumption is that the images of F be compact and convex, and that that the mapping be Lipschitz with respect to the Hausdorff metric. However, if the images of F are unbounded then Lipschitz continuity proves to be rather restrictive. A more general notion is that of sub-Lipschitz continuity. This presentation will describe a particular class of sub-Lipschitz mappings - termed "cosmically Lipschitz", and show that assumptions of this sort can guarantee uniqueness for a generalized Hamilton-Jacobi equation for lower semicontinuous solutions. This unique solution is the value function of the corresponding control problem. (Received February 05, 2001)

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Héctor J Sussmann* (sussmann@math.rutgers.edu), Department of Mathematics, Rutgers, the State University of New Jersey, Hill Center—110 Frelinghuysen Road, Piscataway, NJ 08854. *Path-Integral generalized differentials and the maximum principle of optimal control theory.* Preliminary report.

We propose a new theory of set-valued differentials at a point for (possibly set-valued) maps between finite-dimensional real linear spaces: the "path-integral generalized differentials," abbreviated PIGDs. This theory has all the properties—such as the chain rule and the directional open mapping theorem—needed to make it possible to derive a version of the finite-dimensional Pontryagin maximum principle. Moreover, this theory contains all the others that have been proposed in previous work on the subject, such as J. Warga's "derivate containers," H. Halkin's "screens" and "fans," and the author's "semidifferentials," "multidifferentials," and "generalized differential quotients" (abbr. GDQs). This is so even though those other theories are not comparable with each other since, for example, there are GDQs that are not derivate containers and there are derivate containes that are not GDQs. (Received February 05, 2001)

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Joe Dunn* (dunn@math.ncsu.edu), Mathematics Department, Box 8205, North Carolina State University, Raleigh, NC 27695-8205. *Convergence Questions for Augmented Lagrangian Methods in an Optimal Control Setting.*

We study convergence questions for augmented Lagrangian methods in an optimal control setting. (Received February 05, 2001)

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Michael A. Malisoff* (malisoff@sci.tamucc.edu), Dept. of Computing and Mathematical Sciences, Texas A & M University-Corpus Christi, 6300 Ocean Drive, SBH 211, Corpus Christi, TX 78412-5503. *Recent Results on Viscosity Solutions of the Bellman Equation for Optimal Control Problems with Exit Times.*

We discuss recent results for the Bellman equation associated with deterministic optimal control problems with exit times. We present a viscosity solution approach to the questions of existence and uniqueness of solutions of this equation which guarantees that the value function is the unique solution of this equation that satisfies appropriate side conditions. We apply our results to the Reflected Brachistochrone Problem and to eikonal equations from geometric optics. (Received February 07, 2001)