Editorial

The Cape Verde International Days on Mathematics 2013

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The Cape Verde International Days on Mathematics 2013 (CVIM’13) took place in Praia, island of Santiago, Cape Verde, at the Rectory building of the University of Cape Verde (UniCV), during April 22 to 25, 2013 (http://sites.google.com/site/cvim2013/home/). The conference was held with the support of UniCV, the University of Aveiro (UA), and the Center for Research and Development in Mathematics and Applications (CIDMA) of UA and was organized by Natália Martins (Chair), Gastão S. F. Frederico (Cochair), Nuno R. O. Bastos, Helena Sofia Rodrigues, Delfim F. M. Torres (International Organizing Committee), Adriana S. Carvalho (Chair), João Felisberto Semedo (Cochair), Natália Furtado, Tetyana Gonçalves, and João Carlos Lopes Horta (Local Organizing Committee). It was attended by about 55 Mathematicians and Ph.D. and M.S. students, coming from universities from different countries, such as Algeria, Brazil, Cape Verde, Germany, India, Morocco, Nigeria, Norway, Poland, Portugal, and Sweden. The conference included invited plenary talks and contributed presentations, mainly in the fields of optimization and variational analysis, mathematical systems theory, ordinary and partial differential equations, geometric nonlinear control, fractional calculus, dynamics on time scales, and their applications. It was open to any scientist interested in mathematics and its applications and resulted in a great impact in the news of Cape Verde, in television, radio, and daily newspapers.

The CVIM’13 was a mathematically enriching and socially exciting event and included a visit to the beautiful city of Tarrafal and a conference dinner with traditional Cape Verdean food and music in “Quintal da Música.” The Scientific Committee was chaired by Delfim F. M. Torres (CIDMA and UA, Portugal) and Cochaired by Paulino Lima Fortes (UniCV, Cape Verde) and included a long list of well-known international mathematicians, coming from diverse countries like Brazil, France, Germany, Israel, Morocco, Poland, Saudi Arabia, Spain, Turkey, and USA (see http://sites.google.com/site/cvim2013/scientific-committee/).

This special issue comprises sixteen original research articles that were carefully selected among works presented during CVIM’13. In the article “Overview on the pointwise constrained Liapunov vectorial convexity theorem,” C. Carlota et al. review briefly some necessary conditions and sufficient conditions for solvability of nonconvex vectorial problems with pointwise constraints. The paper “An optimal control framework for resources management in agriculture,” by F. L. Pereira et al., provides a rich optimal control framework to support the management and control of resources in a wide range of problems arising in agriculture. The work of M. R. Sidi Ammi and A. El Hachimi, entitled “Stability and error analysis of the semidiscretized fractional nonlocal thermistor problem,” proposes a finite difference scheme for temporal discretization of the nonlocal time-fractional thermistor problem. Stability and error analysis of the proposed scheme are provided. The article “Optimal control of particle advection in Couette and Poiseuille flows,” by T. Grilo et al. is concerned with a minimum time optimal control problem with...
the dynamics of the control system defined by a set of ordinary differential equations for which the conditions resulting from the application of the Pontryagin maximum principle can be easily solved in an explicit way. “Geometric Hamiltonian formulation of a variational problem depending on the covariant acceleration,” by L. Abrunheiro et al. considers a second-order variational problem depending on the covariant acceleration, which is related to the notion of Riemannian cubic polynomials. Using geometric tools, the dynamics of the control problem is studied with the help of a presymplectic variant of Pontryagin’s maximum principle. The research “Mathematical modeling of atherosclerotic plaque formation coupled with a non-Newtonian model of blood flow,” by T. Silva et al., uses mathematical models and numerical simulations in order to better understand the early formation of atherosclerotic lesions, the rupture of the atherosclerotic plaque, and how this process changes completely the behavior of the blood flow. L. Machado and F. S. Leite study, in “Approximating sets of symmetric and positive-definite matrices by geodesics,” a geodesic fitting problem that generalizes the classical linear regression problem on Riemannian manifolds. The counterpart to the normal equations for the manifold of symmetric and positive definite matrices, equipped with the only metric that is invariant under the natural action of the general linear group, is derived. “Sensitivity analysis in a dengue epidemiological model,” by H. S. Rodrigues et al., gives the sensitivity indices of the basic reproduction number for a dengue epidemiological model, determining the relative importance of its parameters in the disease transmission and disease evolution. The article “Solving a signalized traffic intersection problem with NLP solvers,” by T. M. M. Melo et al., studies a queuing system model resulting from a single signalized traffic intersection regulated by a pretimed control in an urban traffic network. The problem was codified in the AMPL language and solved using different optimization software packages. “Fractional variational problems depending on fractional derivatives of differentiable functions with application to nonlinear chaotic systems,” by M. J. Lazo, proves necessary optimality conditions of Euler-Lagrange type for functionals of the calculus of variations with Lagrangians depending on fractional derivatives of nonlinear functions of the unknown function. The new formulation enables the obtaining of Lagrangians for nonlinear open and dissipative systems. As an example, the author considers a chaotic jerk dynamical system. In the paper “Existence and multiplicity of solutions for a Robin problem involving the \( p(x) \)-Laplace operator,” N. Tsouli et al. study a nonlinear Robin boundary-value problem using the variational method. “An optimal control approach to malaria prevention via insecticide-treated nets,” by C. J. Silva and D. F. M. Torres, considers a mathematical model for the effects of insecticide-treated nets on the transmission dynamics of malaria infection, which takes into account the human behavior. A supervision control is introduced, representing information, education and communication campaigns, and an optimal control problem is proposed and solved, minimizing the number of infected humans while keeping the cost as low as possible. The short article “Noncanonical bases of cycle and cutset spaces of graphs,” by J. M. Simões-Pereira, characterizes those bases of the cycle space and of the cutset space of a graph which cannot be associated with a spanning tree. In the paper “Applied quantum field theory to general diffusion-reaction phenomena,” M. Benhamou reviews quantum field techniques for the extraction of the asymptotic behavior of solutions to parabolic differential equations. “A numerical scheme to solve fractional optimal control problems,” by S. Poosheh et al., reviews recent results to solve fractional order optimal control problems with free terminal time and a dynamic constraint involving integer and noninteger order derivatives. Some particular cases are studied in detail and a numerical scheme, based on expansion formulas for the fractional derivatives, is given. Finally, a “Rigorous study of the unbinding transition of biomembranes and strings from Morse potentials,” by M. Benhamou et al., shows that the Morse potential is a good candidate for the study of the unbinding transition from two interacting manifolds (strings or bilayer membranes).

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