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THE CAPE VERDE INTERNATIONAL DAYS ON MATHEMATICS 2015

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Abstract. The main contributions of [J. Math. Anal. V. 7 Issue 1 (2016)], consisting of ten papers selected and revised from the international conference CVIM'2015, are highlighted.

1. Introduction

Cape Verde (in Portuguese, *Cabo Verde*), is an island country spanning an archipelago of ten islands in the central Atlantic Ocean, with a pleasantly tropical climate with year round average temperatures between 26^oC and 30^oC. Located 600 kilometres off the coast of Senegal, Western Africa, the islands vary in geographical characteristics. They are all of volcanic origin, Fogo being the only volcano still active, most recently erupting in 2014. Mindelo is a port city in the northern part of the island of São Vicente, where The Cape Verde International Days on Mathematics 2015 (CVIM'2015) took place, at the University of Cape Verde (Uni-CV), Campus of Mindelo, São Vicente, Cape Verde, on April 27–30, 2015. The conference was the second one of the CVIM series of conferences initiated in 2013 in the city of Praia, island of Santiago, 2013 [1]. CVIM'2015 promoted, encouraged, and brought together researchers from several fields, mainly from Optimization and Variational Analysis, Mathematical Systems Theory, Ordinary and Partial Differential Equations, Geometric Nonlinear Control and Applications, Fractional Calculus and Applications, and Analysis on Time Scales. The conference consisted of invited plenary talks and contributed paper presentations. It was a mathematically enriching and socially exciting event, with around fifty papers presented at the conference, from which ten papers were selected for the special issue of Journal of Mathematical Analysis, Volume 7, Issue 1, 2016, following a standard review process based on two independent reports. Next we briefly describe the main contributions of these ten papers, in the areas of numerical and computational methods (Section 2), optimization and variational analysis (Section 3), and analysis on time scales (Section 4).

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2. Numerical and Computational Methods

The paper *Numerical Modeling of Marine Pollution: Application to Hydrocarbons Distribution in Tangier Bay*, by Abourida and coauthors, faces the problem of marine pollution in one of the areas exposed to a major pollution threat. A numerical modelling of the hydrocarbons distribution in the bay of Tangier is carried out, solving a coupled model of Navier–Stokes hydrodynamic equations and convection-dispersion transport equations with a numerical technique based on a finite element scheme to compute the transport velocity in order to give a simulation of pollutants' distribution.

In *An Approximation Formula for the Katugampola Integral*, Almeida and Bastos obtain an approximation formula that allows to reduce fractional problems with dependence on Katugampola fractional operators into classical problems involving integer-order derivatives only, which can then be solved by standard numerical and computational methods.

In the manuscript *Computing Quandle Colourings*, Camacho et al. focus on the issue of whether two knots with different Alexander polynomials can be distinguished by linear quandle colourings. The authors end their analysis by providing an algorithm that computes the reduced colouring matrix, taking as input the Gauss code of a diagram of a knot.

In her paper *On the Second Order Differential Equation Satisfied by Perturbed Chebyshev Polynomials*, da Rocha considers perturbations of orthogonal polynomials. By means of a symbolic algebraic algorithm based on Stieltjes equations, she is able to explicit obtain new properties for the complete perturbation of order one and a special perturbation of order two for all four Chebyshev families.

3. Optimization and Variational Analysis

In the article *The Herglotz Variational Problem on Spheres and Its Optimal Control Approach*, Abrunheiro et al. formulate a generalized variational problem of Herglotz type on Euclidean spheres and derive the corresponding Euler–Lagrange necessary optimality equations. The problem is also formulated as an optimal control problem from where the Hamiltonian equations are derived.

In *Dengue Disease: A Multiobjective Viewpoint*, the authors present a mathematical model for the dengue disease transmission, described by a system of ordinary differential equations, and apply multiobjective optimization theory, providing an interesting approach to the optimal control of an important epidemic model. More precisely, an efficient algorithm to solve the problem of finding the optimal dose of insecticide that minimizes simultaneously the cost due to infected human population and the cost associated with the insecticide is investigated. Such multiobjective approach gives the most effective ways of controlling the disease.

In *A Penalty Method for Solving the MPCC Problem*, Melo et al. solve a Mathematical Program with Complementarity Constraints (MPCC) using a penalty technique, from which the complementarity constraints are gathered into a single constraint and included in the objective function. Three algorithms, given in a pseudo-code, are discussed. Numerical experiments are given using a set of AMPL test problems from a well-known database. A comparative analysis of the performance with respect to some metrics is carried out.

In the paper *Optimal Control Strategies for the Spread of Ebola in West Africa*, the authors propose a Susceptible-Infected-Recovered model for Ebola virus. Different optimal control problems are considered, by introducing control functions that represent vaccination and educational campaigns.

4. Analysis on Time Scales

In the paper *Existence of Solution to a Nonlinear First-Order Dynamic Equation on Time Scales*, Bayour et al. investigate a first-order nabla dynamic equation using the concept of tube solution.

In *Dynamical Equivalence of Quasilinear Dynamic Equations on Time Scales*, Reinfelds and Steinberga extend the Hartman–Grobman theorem for dynamic equations without ordinary dichotomy.

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