UNIVERSITY OF BRESCIA

DEPARTMENT OF ECONOMICS AND MANAGEMENT

# MATH TIME II

## *Mini-symposium on Variational Analysis and Applications*

***Friday, June 23rd, 2023, 2:30 PM***, *Sala della Biblioteca, San Faustino Building*

- ***2:30 – 2:40*** ***E. Allevi,*** *University of Brescia*

*Introduction*

- ***2:40 – 3:15*** ***L. Scrimali,*** *University of Catania*

A Stackelberg game formulation of live-streaming platforms under donation-based mechanisms

- ***3:15 – 3:50*** ***M. Passacantando,*** *University Bicocca of Milan*

A finite convergence algorithm for solving linear-quadratic network games with strategic complements and bounded strategies

- ***3:50 – 4:25*** ***M. Carrion,*** *University of Castilla La Mancha*

Optimal hybridization of existing solar power plants: A stochastic programming approach.

- ***4:25 – 5:00*** ***M. Milasi,*** *University of Messina*

Characterizing a class of social ranking functions

**Live presentation on Google Meet** **Registration form here >>**

**Organizing Committee**: E. Allevi, M.R. Domeniguez, G. Oggioni, R. Riccardi, D. Scopelliti

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# ABSTRACTS

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# A Stackelberg game formulation of live-streaming platforms under donation-based mechanisms

Laura Scrimali, Georgia Fargetta

We study the interactions between content creators and viewers in donation- based live-streaming platforms. In these social media systems, creators produce their content, while viewers enjoy the live streaming and decide to donate money to creators. To capture the sequential decision process of the model, we introduce a multi-leader- follower Stackelberg game, in which creators act as the leaders of the game and viewers as the followers. Creators first optimize their performance level and the duration of the streams to maximize their profit. Then, viewers optimize the time spent watching a live stream to maximize their utility. Thus, the first stage of the game models the non-cooperative competition among creators, who make their decisions anticipating viewers' choices. The second stage represents the behavior of viewers deciding on their content demands. We formulate these games as Nash equilibrium problems, and then as variational inequalities. We analyze the existence and uniqueness of the Stackelberg equilibrium. Finally, we present an illustrative numerical example to verify the proposed model.

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# A finite convergence algorithm for solving linear-quadratic network games with strategic complements and bounded strategies

Mauro Passacantando

We propose a new algorithm for solving a class of linear-quadratic network games with strategic complements and bounded strategies. The algorithm is based on the sequential solution of linear systems of equations and we prove that it finds the exact Nash equilibrium of the game after a finite number of iterations. The new algorithm is then applied to a social network model of juvenile delinquency which has been investigated recently where we also consider random perturbations of some data. Experimental results show the efficiency of the algorithm in solving large scale problems.

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# Optimal hybridization of existing solar power plants: A stochastic programming approach.

Miguel Carrión, Rafael Zárate-Miñano, Miguel Cañas-Carretón

Obtaining access and connection rights to transmission and distribution networks is becoming increasingly difficult for renewable energy investors. This delays the incorporation of new renewable energy facilities in power systems. However, considering the variability of the energy production of some renewable technologies, administrations are promoting the hybridization of existing facilities with other technologies to make use of the already assigned connection rights. In this study, we propose a decision-making tool to determine the size and type of alternative technologies that can be used to hybridize existing solar power plants. This is a medium-term planning problem subject to several sources of uncertainty that can be modeled using stochastic programming. The proposed formulation was tested on a realistic case study in which alternative hybridization technologies such as wind power, batteries, and electrolyzers were considered.

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# Characterizing a class of social ranking functions

## Roberto Lucchetti, Monica Milasi, Stefano Moretti

In Social Choice a problem of great interest is to define a ranking for a set of alternatives, given rankings provided by a fixed number $n$ of agents. Thus, we fix a finite set $A = \{a, b, c, \dots\}$ and a positive integer $n$; to each alternative $i \ \in A$ we associate an n-vector $V(i) \coloneqq (v_1, .., v_m), v_s \in I_s$, where$I_s$, $s = 1, \dots, n$ is the interval $I_s \coloneqq \left[\frac{n-s}{n}, \frac{n-s+1}{n}\right]$. $V(i)$ is called a valuation of $i$ and we shall denote by $V_s(i)$ the $s$-th valutation $v_s$ of $i$. $T \coloneqq \left(V(i)\right)_{i \in A}$ is a set of valuations, one for each alternative; we write $V(i, T)$ whenever we need to specify that the evaluation of the alternative i is part of the set $T$ of evaluations. Finally, denote by T(A) the set of all evaluations of dimension $n$ over the set of alternatives $A$. Observe that each single vector of valuations of every alternative is arranged in decreasing order.

Aim of this talk is the study of a class of social ranking Functions. A social ranking solution is a function F: T(A)→ R(A). More precisely, our main result provides a small meaningful set of properties, connected to classical ones in Social Choice, to guarantee that the social ranking function is

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lexicographic. This means that there exists a linear order $L$ on the columns such that in a first step a ranking is made by looking at the evaluations provided by the first column in the order $L$; since in many cases several alternatives can be indifferent, then the above ranking is refined by looking at the second column in the order $L$: this can break some of the previous ties. And so on. We further provide an algorithm that, given a lexicographic F, allows finding the linear order $L$ in the above Definition. Finally, we provide a characterization for three specific lexicographic social ranking functions well known in the literature of Social Choice and Voting.

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