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Alberto Adrego Pinto • David Zilberman
Editors

Modeling, Dynamics, Optimization and Bioeconomics I

Contributions from ICMOD 2010
and the 5th Bioeconomy Conference 2012

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To our families

Alberto Adrego Pinto

I first met Alberto Pinto when he was taking a master's course at the University of Warwick. He was very enthusiastic about the subject of my lectures that were about the boundary between order and chaos in dynamical systems, particularly those, like period doubling, that could be analysed using renormalisation. He worked with me on his master's thesis that studied the work of Feigenbaum and Sullivan on scaling functions, and he went on to a PhD on the universality features of other classes of maps that form the boundary between order and chaos.

During this time he met a number of leaders in dynamical systems, notably Dennis Sullivan and Mauricio Peixoto, and this had a great impact on his career. As a result he and his collaborators have made many important contributions to the study of the fine-scale structure of dynamical systems, and this has appeared in leading journals and in his book *Fine Structures of Hyperbolic Diffeomorphisms* co-authored with Flávio Ferreira and myself.

I would like to pick out his important work with Welington de Melo. While doing postdoc with Dennis Sullivan at the Graduate Center at City University of New York he met Edson de Faria and through Mauricio Peixoto he got in contact with Welington de Melo. With de Melo he proved the rigidity of smooth unimodal maps in the boundary between chaos and order extending the work of McMullen. Furthermore, de Faria, de Melo and he proved the conjecture raised in 1978 in the work of Feigenbaum and Coullet-Tresser which characterises the period-doubling boundary between chaos and order for unimodal maps. This appeared in the *Annals of Mathematics* and was based in particular on the previous works of Sandy Davie, Dennis Sullivan, Curtis McMullen and Mikhail Lyubich.

Since then Alberto has branched out into more applied areas. He has contributed across a remarkably broad area of science including optics, game theory and mathematical economics, finance, immunology, epidemiology, and climate and energy. In these applied areas he has published widely and edited two books.

With Michel Benaïm he founded the *Journal of Dynamics and Games* of the *American Institute of Mathematical Sciences* (AIMS) and they are the editors in chief. He has also increasingly taken on important administrative tasks. For example, he is currently the President of International Center for Mathematics

(CIM), Portugal and has started the CIM Mathematical Sciences Series to be published by Springer-Verlag.

I was very lucky to have had Alberto as a student and I have greatly enjoyed collaborating with him. He is a deep thinker and extremely focused and determined and working with him has been always fun.

Coventry, United Kingdom
December 2013

David Rand

David Zilberman

David Zilberman is a Professor and holds the Robinson Chair in the Department of Agricultural and Resource Economics at U.C. Berkeley. David has made major contributions to several major areas of research in agricultural and environmental economics. In water economics, he introduced a framework to evaluate and estimate adoption of advanced irrigation technology and analyze the performance of alternative water allocations, including water rights vs. water trading. He also introduced the damage control model to assess pesticides productivity and a framework to consider existing policies in designed new regulations.

His work provided empirical evidence of the gains associated with adoption of Genetic modified varieties, and he introduced a clearinghouse for intellectual property to enable development of technologies for the poor. He was among the first to identify the trade-offs between food and the fuel associated with introduction of biofuels and developed quantitative methods to assess the economic and environmental impacts of biofuel. David also made a major contribution to the economics of payment for ecosystem services, adoption, and risk.

David is a Fellow of the American Agricultural Economics Association (AAEA) and the Association of Environmental and Resource economics (AERE) and is the recipient of the 2000 Cannes Water and the Economy Award. He won the AAEA 2002 and 2007 Quality of Research Discovery Award and the 2005 and 2009 AAEA Publication of Enduring quality award. He edited 17 books and coauthored 280 papers in refereed journals. David received his B. A. in Economics and Statistics at Tel Aviv University, Israel, and his Ph.D. at the University of California, Berkeley, in 1979. He has served as a consultant to the World Bank, FAO, USDA, EPA, and CDFA. He served as Department Chair from 1994 to 1999 and was on the boards of the AAEA and C-FARE and on three NRC panels.

Preface

The aim of the project of this book “Modeling, Dynamics, Optimization and Bioeconomics I” is the exploration of emerging and current cutting-edge theories and methods of modeling, optimization, dynamics and bioeconomy. The theories and techniques presented here originated from dynamics, statistics, control theory, computer science and informatics and are applied to novel and innovative real-world applications. During the past decades, the use of dynamic systems, control theory, computing, data mining, machine learning and simulation has gained the attention of numerous researchers from all over the world. Smart or intelligent algorithms are often called heuristics and model-free. They are usually less firm in mathematical rigor but liberated from the strictness of calculus in order to integrate nature-inspired and, especially, bio-inspired approaches to solve hard problems efficiently. Herewith, these intelligent algorithms have evolved in parallel with the development of model-based, mathematical models.

Admirable scientific projects using both model-free and model-based methods coevolved today at research centers and are introduced in conferences around the world, yielding new scientific advances and contributing to the solution of important real-world problems. One important area of progress is the bioeconomy—where advances in life sciences are used to produce new products in a sustainable and clean manner. In this book, scientists from all over the world share their latest insights and important results in the field.

We are very thankful to the editors, Alberto Adrego Pinto and David Zilberman, for having given these experts the opportunity and honor of publishing their contributions. We express our gratitude to them for having prepared a premium work of a remarkable scientific and social value!

Ankara, Turkey
December 2013

Gerhard-Wilhelm Weber

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The majority of the contributed papers for this volume come from the participants of the International Conference on Modeling, Optimization and Dynamics—ICMOD 2010,¹ a satellite conference of EURO XXIV Lisbon 2010, that took place at Faculty of Sciences of University of Porto, Portugal, and from the Berkeley Bioeconomy Conference 2012² at University of California, Berkeley, USA. We thank all authors for their contribution to this volume.

¹<https://sites.google.com/site/workshopeuro2010/>.

²<http://www.berkeleybioeconomy.com/conference/2012-conference/>.

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