

# Preface

The title of this book—“Recurrence Plots and Their Quantifications: Expanding Horizons”—suggests humble beginnings, leaps in understanding, and continued spreading of recurrence ideas into multiple fields of inquiry. The world and its uncountable dynamical systems seem to function on fundamental principles of recurrence in linear and as well as nonlinear domains, operating on different temporal and spatial scales and over various dimensions. When one thinks about it, the sun recurs every day, but at slightly different positions along the horizon. The beating wings of birds and insects recur, producing up and down motions for propulsion. Movements in humans recur, from the scratching of an itch, to the many gaits of locomotion and stages of sleep/wake patterns. Words in a book recur, making possible the writing very long texts larger than the vocabulary size selected. And DNA codes recur, giving instructions for the production of specific proteins that make life itself possible. Indeed, life itself recurs through reproduction!

Yes, we live in a recurrent world, nay universe, which explains why symposia after recurrence symposia, new and useful research applications keep popping up for recurrence plots (RPs) and recurrence quantifications (RQs) in virgin systems as it were. There is literally no end in sight as the collection of papers herein bears witness. Specifically, this present volume represents 19 selected papers presented, discussed, and debated over at the Sixth International Recurrence Plots Symposium held in Grenoble France (June 17–19, 2015). More than 50 participants from around the world interacted. Some scientists were new to the meeting, but others “recurred” having attended one or more of the five previous symposia (Potsdam 2005, Siena 2007, Montreal 2009, Hong Kong 2011, Chicago 2013).

The structure of this book is divided into two parts: methodological and practical. Part one addresses theoretical topics with examples such as recurrences in large data sets, transient and non-stationary signals, complexity testing, approximate recurrences and the new splayed recurrence analysis (Chaps. 1–7). Part two focuses on specific dynamical systems that employ recurrence strategies and are grouped into four categories consisting of three chapters each. The first group readdresses now familiar recurrent systems in human physiology including heart

and brain rhythms (Chaps. 8–10). Second coordinated systems are studied including those related to human interpersonal behaviors, social-motor coordination, and even monetary systems which are heavily influence by human activity (Chaps. 11–13). Papers in the third group of center on hydraulics and hydrology including the complex dynamics of underwater acoustics, water temperature fluctuations, and eddy current fluxes (Chaps. 14–16). Finally, group four introduces uses of recurrence analyses in combustion dynamics and flashbacks, turbulence in plasmas, and ultrasonic testing in polymers (Chaps. 17–19). Indeed, creative recurrence ideas as strategies are expanding the horizon into numerous scientific disciplines. That is precisely why “Expanding Horizons” was chosen as part of this book’s title.

The editors and authors welcome you to the fascinating, even beautiful world of recurrences. By reading this book may you become excited about how recurrence analysis might be useful to your own field of study no matter what interests you scientifically. The invitation is extended to all to feel free to contact any of the authors regarding their contributions.

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