PHILOSOPHICAL TRANSACTIONS A

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Preface

Cite this article: Tlidi M, Clerc MG, Panajotov K. 2018 Dissipative structures in matter out of equilibrium: from chemistry, photonics and biology, the legacy of Ilya Prigogine (part 2). *Phil. Trans. R. Soc. A* **376**: 20180276. http://dx.doi.org/10.1098/rsta.2018.0276

Accepted: 18 September 2018

One contribution of 12 to a theme issue 'Dissipative structures in matter out of equilibrium: from chemistry, photonics and biology (part 2)'.

Subject Areas:
optics

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Dissipative structures in matter out of equilibrium: from chemistry, photonics and biology, the legacy of Ilya Prigogine (part 2)

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The first volume of the theme issue concentrated on the theory of dissipative structures. In this volume, we focus on its applications in various fields of nonlinear science. The contributions concern:

(i) Photonics and optical systems: recent major developments in the application of Lugiato–Lefever model of driven nonlinear resonators that support temporal dissipative structures. The link between these structures and the Kerr frequency comb generation in microresonators is presented in the first contribution [1]. Optical pattern formation usually involves the combination of diffraction and nonlinearity in a Kerr medium. The second contribution [2] describes another mechanism by which light spontaneously induces dissipative structures in nematic states of dye-doped liquid crystal. The mechanism involves the photoisomerization process of the dopants.

(ii) Spiral structures in excitable media and population dynamics: In [3], Vladimir Zykov reviews the formation of spiral waves in excitable media. Spirals and arcs like vegetation patterns are observed and analysed in arid-ecosystems. Interpretation of these observations and the predictions provided by the theory is illustrated by recent measurements of peculiar plant morphology

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(the alfa plant, or *Stipa tenacissima* L.) originated from northwestern Africa and the southern part of the Iberian Peninsula. It should be noted that the spirals reported in this contribution are not waves, they do not rotate, and they are obtained in strictly homogeneous environmental conditions [4]. When conditions are not isotropic, homoclinic stripes of any length can be stabilized [5]. Population dynamics of swarm soldier crabs are analysed by applying the Bayesian and inverse Bayesian inference in [6]. These modern methods allow to reveal decision making in social animals as a bifurcation process.

(iii) Chemomechanical stability, localized structures, influence of fluctuations and noise: The possible occurence of chemomechanical oscillations in adsorptive porous media whose porosity varies nonlinearly with surface coverage is investigated in [7]. The next paper explores different mechanisms leading to the formation of spatially dissipative localized structures in the one-dimensional reaction–diffusion models [8]. Numerical continuation techniques and weakly nonlinear theory are used to analyse in depth their global behaviour [8]. Bifurcation analysis of the localized spot and a self-replication instability leading to bound states of localized spots are analysed by using two-dimensional continuation techniques in [9].

(iv) Fluctuations out of equilibrium: a generalized version of the Callen–Welton fluctuation–dissipation formula is provided with the application to an electrical oscillation circuit in [10]. When fluctuations are considered, the description of macroscopic systems is inherently probabilistic. In this case, the evolution of the probability of being in a definite state and the mean life of the different states in which the system can reside are evaluated using an approach based on path integrals in [11].

Acknowledgements. We thank all authors for their valuable contributions to the two volumes of this theme issue (19 countries from five continents). The guest editors of this volume are extremely grateful to Bailey Fallon, the journal's Commissioning Editor of *Philosophical Transactions A of the Royal Society* for all the support and help during the process leading to the publication of the theme issue. We acknowledge the support of the University of Chile, Pontificia Universidad Catolica de Valparaiso, Wallonie-Bruxelles International, the Fonds National de la Recherche Scientifique (Belgium), and the International Solvay Institutes, Brussels.

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