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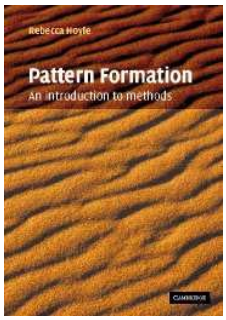
Pattern Formation—*An Introduction to Methods*, by Rebecca Hoyle, 2006. Cambridge University Press, The Edinburgh Building, Cambridge, CB2 2RU, United Kingdom. Hardback, 422 pages. Price GBP 45.00. ISBN 0-521-81750-1.



The book describes mathematically different regular patterns that are commonly observed in nature; therefore, it is useful in many disciplines of the natural sciences. The book describes in details many processes that are important and common, but not exclusive, to geology, and that are not often viewed from the mathematical viewpoint. Among these processes are, for instance, the formation of ripples on a sandy substrate, convection cells that eventually induce plate tectonics, groundwater or crystals in a magma chamber, and reaction-diffusion of substances.

The book contains eleven chapters that describe specific patterns such as bifurcation, simple lattice patterns, spatial modulation and envelope equations, instabilities of patterns, spirals and defects. Many of these topics are described in general in key chapters and further developed in greater complexity in complementing chapters. The chapters contain many suggestions of literature for either basic aspects of the equations presented in the text or their discussion in more depth.

The first chapter of the book is an excellent introduction to the concepts and mathematics behind the theory of patterns. The author uses a lot of practical examples with a minimum use of mathematics to illustrate and attract the attention of the reader with many examples in nature of the occurrence of those patterns, such as the development of stripes and spots in animals, and sand ripples. This introductory chapter also presents a simple, funny, and illustrative experiment to demonstrate convective hexagonal patterns using heated cooking oil that “you can make in your own kitchen”.

The “easy to digest” part of the book, at least for geologists with standard level of mathematics, however, ends already with the first chapter. Mathematics becomes more complex in the following chapters making understanding of the principles shown in the book difficult. The chapters 2, 3 and 4 describe bifurcation patters, while chapters 5 and 6 describe different types of lattice patterns. Spatial modulation and envelope equations, including those that describe conservation of angular momentum are presented in chapter 7. Chapters 8 and 9 present the mathematics behind instabilities of patterns, such as those occurring in stripe patterns. Chapters 10 and 11 describe patterns of spirals and defects of spirals, and large-aspect-ratio systems, respectively. All chapters contain at the end exercises related to the most important topics described. At its end, the book contains an alphabetic index that facilitates the rapid search for specific topics treated in the various chapters.

I must say the book is exciting and surprising, as it explains many phenomena that we, geologists, never think about, especially regarding their mathematic description. The book is, therefore, worth its price. I am tempted to say, however, that it is of quite difficult comprehension on a first reading, as the book is assumedly aimed for “upper-undergraduate mathematic students”. One should be prepared to read many of the chapters more then once and eventually

search for additional literature for a complete understanding. Intermediate to advanced knowledge of mathematics is a must.

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