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BOOK REVIEW

The Mechanics and Mathematics of Biological Growth, by Alain Goriely, Springer, New York, xxii+646 pp, ISBN 978-0-387-87709-9.

This extensive monograph concerns the mathematical and mechanical theory for biological growth and provides a comprehensive and extensive survey of research activities devoted to this field since the pioneering work of Galilei Galileo more than three centuries ago. The book grasps the conceptual and technical aspects underpinning the role of mechanics in the growth of biological tissues. It is the first major modern monograph on the subject, which synthesizes the research activity in this vivid field of the mathematics and mechanics of growth since now more than two decades. The presented theories and methods are illustrated by examples and applications, which makes the book accessible even for non specialists.

The monograph is divided into five parts of increasing complexity, starting with the one dimensional treatment and then extending to two and three space dimensions. After a comprehensive introduction devoted to the problem of growth treated from a historical and phenomenological perspective (Part I), basic concepts are introduced in Part II for the growth of filamentary structures, successively handling line growth and growing rods (conned morphoelastic rods) based on a general treatment of the mechanics of helical structures. The problem of growth-induced instabilities is addressed with application to growing vines. The third part is devoted to surface growth for two dimensional objects, focusing the discussion to axisymmetric membranes and shells, which proves useful for modeling the growth of seashells, horns, antlers, leaves, flowers, or pollen tubes. An important distinction is made here between hard and soft surfaces, the first ones being hard to deform and growing by accretion of mass only locally, whereas the deformable surfaces develop a fair amount of elastic deformations so that growth is distributed over the entire surface. Historically, two distinct approaches of surface growth have been employed, considering either boundary accretion in a mechanistic approach or a parametric description. These two distinct approaches are illustrated for the situation of seashell growth. The more general problem of developing a theory of the growth of shells lies outside the scope of the book. A theory of axisymmetric