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Titolo	Invitation to Topological Robotics [[electronic resource] /] / Michael Farber
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ISBN	3-03719-554-1
Descrizione fisica	1 online resource (143 pages)
Collana	Zurich Lectures in Advanced Mathematics (ZLAM)
Classificazione	58-xx57-xx
Soggetti	Analytic topology Mechanical engineering Global analysis, analysis on manifolds Manifolds and cell complexes
Lingua di pubblicazione	Inglese
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Sommario/riassunto	The book discusses several selected topics of a new emerging area of research lying on the interface between topology and engineering. The first main topic of the book is topology of configuration spaces of mechanical linkages. These manifolds arise in various fields of mathematics and in other sciences, e.g. engineering, statistics, molecular biology. To compute Betti numbers of these configuration spaces we apply a new technique of Morse theory in the presence of an involution. A significant result of topology of linkages presented in the book is a solution of a conjecture of Kevin Walker which states that the relative sizes of bars of a linkage are determined, up to certain equivalence, by the cohomology algebra of the linkage configuration space. The book also describes a new probabilistic approach to topology of linkages which treats the bar lengths as random variables and studies mathematical expectations of Betti numbers. The second main topic of the book is topology of configuration spaces associated to polyhedra. The book gives an account of a beautiful work of S.R. Gal suggesting an explicit formula for the generating function encoding Euler characteristics of these spaces. Next we study the knot theory of

a robot arm focusing on a recent important result of R. Connelly, E. Demain and G. Rote. Finally, the book investigates topological problems arising in the theory of robot motion planning algorithms and studies the homotopy invariant TC(X) measuring navigational complexity of configuration spaces. The book is intended as an appetizer and will introduce the reader to many fascinating topological problems motivated by engineering.