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2.	Record Nr.	UNINA9910890190903321
	Autore	Reinken Henning
	Titolo	Controlling Mesoscale Turbulence : The Impact of Translational and Rotational Constraints on Pattern Formation in Microswimmer Suspensions / / by Henning Reinken
	Pubbl/distr/stampa	Cham : , : Springer Nature Switzerland : , : Imprint : Springer, , 2024
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	Descrizione fisica	1 online resource (233 pages)
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	Disciplina	620.19
	Soggetti	Soft condensed matter
		Colloids
		Statistical physics
		System theory
		Soft Materials
		Statistical Physics
		Complex Systems
		Fluids
	Lingua di pubblicazione	Inglese
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	Livello bibliografico	Monografia
	Nota di contenuto	Introduction -- Theoretical Concepts -- Derivation of a Continuum Theory -- Unconstrained Mesoscale Turbulence -- Reorienting External Fields -- Obstacle Lattices,- Conclusions and Outlook -- Appendix.
	Sommario/riassunto	This thesis combines methods from statistical physics and nonlinear dynamics to advance research on the pattern formation in active fluids in several directions. In particular, it focuses on mesoscale turbulence, a state observed in microswimmer suspensions, which is characterized by the emergence of dynamic vortex patterns. The first major contribution concerns the bottom-up derivation of a frequently used continuum model of mesoscale turbulence from a set of particle-resolved stochastic equations. Utilizing the model, mesoscale turbulence is shown to induce nontrivial transport properties including a regime of optimal diffusion. The thesis then explores possible strategies of control. One of these relies on an external field that leads

to stripe-like structures and can even suppress patterns entirely. The other involves geometric confinement realized by strategically placed obstacles that can reorganize the flow into a variety of ordered vortex structures. The turbulence transition inside an obstacle lattice is shown to have an intriguing analogy to an equilibrium transition in the Ising universality class. As a whole, this thesis provides important contributions to the understanding and control of turbulence in active fluids, as well as outlining exciting future directions, including applications. It includes a substantial introduction to the topic, which is suitable for newcomers to the field.