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Network Structures from Selection Principles VITTORIA COLIZZA, School of Informatics, Indiana University, 901 E. 10th Street, Bloomington, IN 47408 USA, JAYANTH R. BANAVAR, Department of Physics, The Pennsylvania State University, 104 Davey Laboratory, University Park, PA 16802 USA, AMOS MARITAN, Department of Physics, University of Padova, Via Marzolo 8, 35131 Padova, ITALY, ANDREA RINALDO, Centro Internazionale di Idrologia "Dino Tonini" and Dipartimento IMAGE, Università di Padova, I-35131 Padova, ITALY
— We present an analysis of the topologies of a class of networks which are optimal in terms of the requirements of having as short a route as possible between any two nodes while yet keeping the congestion in the network as low as possible. Strikingly, we find a variety of distinct topologies and novel phase transitions between them on varying the number of links per node. Our results suggest that the emergence of the topologies observed in nature may arise both from growth mechanisms and the interplay of dynamical mechanisms with a selection process.

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