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Abstract:

Since the great mathematician Leonhard Euler initiated the study of graph theory, the network has been one of the most significant research subject in multidisciplinary. In recent years, the proposition of the small-world and scale-free properties of complex networks in statistical physics made the network science intriguing again for many researchers. One of the challenges of the network science is to propose rational models for complex networks. In this paper, in order to reveal the influence of the vertex generating mechanism of complex networks, we propose three novel models based on the homogeneous Poisson, nonhomogeneous Poisson and birth death process, respectively, which can be regarded as typical scale-free networks and utilized to simulate practical networks. The degree distribution and exponent are analyzed and explained in mathematics by different approaches. In the simulation, we display the modeling process, the degree distribution of empirical data by statistical methods, and reliability of proposed networks, results show our models follow the features of typical complex networks. Finally, some future challenges for complex systems are discussed.

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