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Special Topic: Network Science and Engineering

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Preface

Complex networks are ubiquitous in our lives. Representative examples are the Internet, social networks, biological networks, E-commerce networks, electrical power grids, and larger-scale engineering systems. It is well known that the Internet has been a powerful engine for our societal evolution and technological innovation. Nowadays, network science and engineering faces fundamental challenges, such as understanding the complexity of various large-scale networks, developing new architectures and exploiting new substrates, and enabling new applications and new economics. To a better future, the complex networks in our lives will need to be better: more accessible, more reliable, more predictable, and more secure.

Traditionally, complex networks are investigated via graph theory. In 1960, Erdös and Rényi introduced the famous ER Random Graph model. The ER Random Graph model dominated research for about 40 years. Recently, the availability of Big Data and supper-fast computing power has led to a rethinking of the above approach. Two significant recent discoveries are the small-world effect discovered by Watts and Strogatz in 1998, and the scale-free feature found by Barabási and Albert in 1999. In 2009, the United States National Science Foundation released a report on network science and engineering. In the same year, *Science* published a special issue on complex systems and networks. In 2015, the National Science Foundation of China organized the ShuangQing Forum on a future smart Internet. According to their 2015 annual report, the United States Department of Defense will focus on six disruptive basic research areas, including the computational models of human behavior in social networks. After rapid development over more than one decade, network science and engineering faces several challenges: 1) developing a theory of networked computing; 2) developing the foundations of a theory of network architecture that allows rigorous analysis and systematic design of complex networked systems; 3) developing new network protocol design methods to implement the protocol-related elements of networked systems; 4) developing and popularizing a common mathematical language to broaden and deepen the contacts between and across networks in engineered systems and networks in the sciences. To promote the rapid development of network science and engineering, we invited leading scientists in China to discuss the recent advances and future directions of network science and engineering.

Science China Technological Sciences (*Sci China Tech Sci*) provides us a wonderful platform on which to share our recent advances in this field. We would like to thank all invited authors, reviewers, and the editorial staff of *Sci China Tech Sci* for their great contributions to our special issue. We believe that this special issue will benefit researchers in the field of network science and engineering.

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