

Design Methodology of Networked Software Evolution Growth Based on Software Patterns

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摘要 Recently, some new characteristics of complex networks attract the attentions of scientists in different fields, and lead to many kinds of emerging research directions. So far, most of the research work has been limited in discovery of complex network characteristics by structure analysis in large-scale software systems.

This paper presents the theoretical basis, design method, algorithms and experiment results of the research. It firstly emphasizes the significance of design method of evolution growth for network topology of Object Oriented (OO) software systems, and argues that the selection and modulation of network models with various topology characteristics will bring un-ignorable effect on the process of design and implementation of OO software systems. Then we analyze the similar discipline of “negation of negation and compromise” between the evolution of network models with different topology characteristics and the development of software modelling methods. According to the analysis of the growth features of software patterns, we propose an object-oriented software network evolution growth method and its algorithms in succession. In addition, we also propose the parameter systems for OO software system metrics based on complex network theory. Based on these parameter systems, it can analyze the features of various nodes, links and local-world, modulate the network topology and guide the software metrics. All these can be helpful to the detailed design, implementation and performance analysis. Finally, we focus on the application of the evolution algorithms and demonstrate it by a case study.

Comparing the results from our early experiments with methodologies in empirical software engineering, we believe that the proposed software engineering design method is a computational software engineering approach based on complex network theory. We argue that this method should be greatly beneficial for the design, implementation, modulation and metrics of functionality, structure and performance in large-scale OO software complex system.

关键词 [Complex networks, evolution growth design method, growth characteristics of software patterns, networked software, OO software network, types and modulation of preferential attachment](#)

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Abstract Recently, some new characteristics of complex networks attract the attentions of scientists in different fields, and lead to many kinds of emerging research directions. So far, most of the research work has been limited in discovery of complex network characteristics by structure analysis in large-scale software systems. This paper presents the theoretical basis, design method, algorithms and experiment results of the research. It firstly emphasizes the significance of design method of evolution growth for network topology of Object Oriented (OO) software systems, and argues that the selection and modulation of network models with various topology characteristics will bring un-ignorable effect on the process of design and implementation of OO software systems. Then we analyze the similar discipline of “negation of negation and compromise” between the evolution of network models with different topology characteristics and the development of software modelling methods. According to the analysis of the growth features of software patterns, we propose an object-oriented software network evolution growth method and its algorithms in succession. In addition, we also propose the

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parameter systems for OO software system metrics based on complex network theory. Based on these parameter systems, it can analyze the features of various nodes, links and local-world, modulate the network topology and guide the software metrics. All these can be helpful to the detailed design, implementation and performance analysis. Finally, we focus on the application of the evolution algorithms and demonstrate it by a case study. Comparing the results from our early experiments with methodologies in empirical software engineering, we believe that the proposed software engineering design method is a computational software engineering approach based on complex network theory. We argue that this method should be greatly beneficial for the design, implementation, modulation and metrics of functionality, structure and performance in large-scale OO software complex system.

Key words [Complex networks](#) [evolution growth design method](#) [growth characteristics of software patterns](#) [networked software](#) [OO software network](#) [types and modulation of preferential attachment](#)

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