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Author(s)	藤本, 幸伸
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A research on consistency in analysis models of large-scale systems

Yukinobu Fujimoto (010102)

School of Information Science,
Japan Advanced Institute of Science and Technology

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1 Background

Recently, object-oriented approach is becoming the mainstream of software developments. UML is used as a standard modeling language of object-oriented analysis and the design. UML was proposed by unifying models which are used in methodologies proposed by Booch, Rumbaugh and Jacobson. In existing UML editors, the description and meaning of the models are informal. Therefore, it is difficult to provide consistency among the models constructed by two or more designers. Object-oriented developments are effective to designing large-scale systems. In such system, model descriptions are very large. This makes it difficult to provide the consistency. Providing the consistency is important to design the systems precisely.

2 Purpose

In this research, we used *the ITS on-board system architecture* as an example of the large-scale system to which object-oriented development methods are applied. Purposes of this research are to investigate consistency between the analysis models of the large-scale system, to make the problem clear of the inconsistency in industries and to propose a computer support environment for a consistency verification of large-scale systems. And then, we consider a method to provide the consistency.

3 Contents of research

In *the ITS on-board system architecture*, the structure of services to be provided in ITS is described using the class chart and the collaboration chart of UML and other documents. In this research, I focus on *the control models*, *the method models* and *the individual models*. I verified two kinds of consistency among them. One is consistency between *the individual models* and *the method models*. Another is consistency between *the control models* and *the method models*. In the former, those abstraction levels are the same to each other. In this consistency verification, we detected many inconsistencies which are caused by simple mistakes such as miss types. We proposed a method for detecting such inconsistencies. And implemented a tool which automatically detects them. This tool was based on Rational Rose(Rational Software Co.) and Excel(Microsoft Co.). On the other hand, in the latter, those abstraction levels are quite different and they are informally constructed. These make it very hard to check the consistency between them. To solve these problems, we proposed a model construction method so that we can check the consistency among them. Then, we verify models constructed in the proposed method using OCL.

4 Conclusion

In this research, we verified the models of *the ITS on-board system architecture* as an example of large-scale systems. We discovered the inconsistencies such as miss typing and omissions. Though these inconsistencies are very simple, in fundamental systems such as *the ITS on-board system architecture*, they have potential abilities to cause serious disasters. But it is difficult to check by review, because there are huge amount of informations with designing large-scale systems. A computer has a power of managing simple and huge amount of informations. So, in this research, we made the script of verifying inconsistency automatically with Excel and applied to models. As a result, we succeeded to check inconsistency and rise a trust of the models. It is easy to make this script. So it is the effective method for developing other large-scale systems.