A Testing Method for ObTS using CPN

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In software development processes, software may involve many errors. These errors must be detected and corrected. However, it is not easy to detect all of them in early phase. Testing is the process to detect errors existing in model. So testing is very important to develop high-quality software. Establishment of the testing method which is well suited for particular software development method yields efficiency and lowering cost of software development.

Recently, computer systems become larger and more complex. To develop software for such enviroment, object-oriented software development methodologies are introduced. However, in object-oriented software development, there are dynamically determined properties which make testing of software difficult. So testing is more difficult than other software development methods. Consequently, the testing method for object-oriented software is not finalized.

In this paper, a test method which is used to support the object-oriented software development is proposed. By using formal specifications description model ObTS, the concurrency model is described. Next, the specifications of the model which was previously described are converted into Coloured Petri-Net(CPN). Then, the test of CPN is done by using the test tool Design/CPN, and the problem of the model is discovered. The main point of this research is to propose the conversion rule between ObTS and CPN. After converting the model from ObTS to CPN, the model checking is then tested by using Design/CPN.

As a formal specification model for object-oriented methodology, ObTS is proposed. In ObTS, system structure is composed by hierarchy of objects, and system behavior is expressed by behaviors of objects and inter-object communications. ObTS has ObCL which is a specification language based on it, and has ObML which is a simulation environment for it. A system which is described by ObCL codes is converted to ML codes by ObCL converter, and these codes can be simulated in ObML to confirm the behavior.

But the simulation environment ObML is not strong enough for software developer to test the system.

CPN extends Petri-Nets using the attribute of color and support concurrency. There is a high function tool Design/CPN in CPN, and a test can be done by using this. As the general idea of the hierarchical CPN is being used Design/CPN, and a concurrency can handle with Design/CPN easily. And, the occurrence graph is formed with Design/CPN as a result that simulation was done. A developer can analyze it about the feature such as reachability and liveness, and detect errors like deadlocks by using occurrence graph.

In this paper, the conversion rule used to tranceform ObTS to CPN was defined. Firstly, it pays attention to the structure of the ObTS model, and the basic conversion rule was defined. The state of ObTS is changed into place of CPN, and the transition of ObTS is trancefor into transition of CPN. The transition of CPN has a transition rule net as a sub-net at this time. Furthermore, an expansion conversion rule was defined to fill behavior semantics of ObTS. The schedule net and an event control net are formed by applying an expansion conversion rule, and a change is done by expanding a object net. The schdule net shows the general idea of the step in behavior semantics of ObTS. The token which shows a event is reproduced, and transmission is done with the event control net to each object of the plural to express broadcast communication. A conversion from ObTS to CPN became possible by using the basic conversion rule and an expansion conversion rule establised in this research. The conversion rule which defined is applied to the execise,the action of ObTS is the same as the action of converted CPN.