Program comprehension and its application based on simulation on domain world model

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In this paper I propose a framework of program comprehension based on a domain world model and its application to verification of programs. Many reserachers have developed plan recognition methods or/and some structural graphs and have tried to construct frameworks of program comprehension mainly based on pattern matching to abstract templates. However, in general, program is a description of operations to solve problems in some domain worlds. Therefore, it is important to analyze what effect each instruction has on the domain world operated by the program.

From this standpoint, I propose a framework to grasp meaning of an instruction depending on the context by detecting the difference between the world model before simulating the instruction and that after the simulation. In order to implement such a framework, this paper discusses the structure of the world model, how to simulate the behavior of programs on the world model, how to manage the situation, and how to grasp the role which each instruction of the program plays on the situation.

I also propose a method of constructing a tool which is used to verify programs by using the framework. I adopt a format based on state transition diagrams to describe specifications. Therefore, I design a "state transition" based description of results of the program understanding. I propose an algorithm to judges whether the program satisfies the specification by matching the both descriptions, and implement an experimental system. Using the system, users can check the programs at mechanical motion level which is independent of programming language.