

# Formal Engineering Methods for Software Quality Assurance

Shaoying Liu

Department of Computer Science

Hosei University

<http://cis.k.hosei.ac.jp/~sliu/>

## Abstract

Conventional software engineering on the basis of informal or semi-formal methods is facing tremendous challenges in ensuring software quality and productivity. Formal methods have attempted to address those challenges by introducing mathematical notation and calculus to support formal specification, refinement, and verification in software development. The theoretical contributions of formal methods to the discipline of software engineering are significant. However, in spite of their potential in improving the controllability of software process and reliability, formal methods are generally difficult to apply to large-scale and complex systems in practice because of many constraints (e.g., limited expertise, complexity, changing requirements, and theoretical limitations).

We have developed the “Formal Engineering Methods” (FEM) as a research area since 1990 to study how formal methods can be effectively integrated into conventional software engineering process so that formal techniques can be tailored, revised, or extended to fit the need for improving software productivity and quality in practice (e.g., through the enhancement of the usability of formalism and the tool supportability of the relevant methods). We have also developed a specific FEM called Structured Object-oriented Formal Language (SOFL) that offers rigorous but practical techniques for system modeling, transformation, and verification: three-step formal specification, transformation from structured specification to object-oriented implementation, and specification-based inspection and testing. The effective combination of these three techniques can significantly enhance software productivity and quality. The SOFL method has also achieved a good balance among simplicity, visualization, and preciseness to allow engineers to easily use the method. In this talk, I will first give a brief introduction to FEM and then focus on the issue of how SOFL is used for software quality assurance.