DOCTORAL CANDIDATE:	KA I PUN
DEGREE:	Philosophiae Doctor
FACULTY:	Mathematics and Natural Sciences
DEPARTMENT:	Infomatics
AREA OF EXPERTISE:	Static analysis, formal methods
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DISSERTATION TITLE: *Behavioural Static Analysis for Deadlock Detection*

Concurrency is a ubiquitous phenomenon in modern computer systems. Concurrent systems consist of a number of system components, for example, functions or procedures, running simultaneously, and may communicate with each other. Shared use of resources among concurrent system components may result in concurrency-related errors like deadlocks, which is a situation where one or more processes in a program are blocked forever while waiting for each other. Numerous computer programs make use of concurrent systems, including financial-critical and safety-critical applications. The reliability of such systems is therefore a crucial concern. Guaranteeing the correctness of concurrent computer software is a challenging problem in computer science. The complication mainly comes from the non-deterministic interleaving order between different components, which makes concurrency errors difficult to reproduce, and hence to identify.

This dissertation develops formal static methods to ensure deadlock freedom, a prominent safety property of concurrent programs, in the early stage of the development cycle, before the software is executed. Hence, ultimately the methods enhance the quality of concurrent programs. The methods use type- and effect-based analyses to capture the behaviour of programs, which over-approximates all the execution order of program statements. The behaviour is in a simulation relation with the concrete programs for deadlock detection. Formally proven correct analyses can guarantee deadlock freedom in concurrent programs.