An Evolving Algebra Solution to the Steam-Boiler Control Specification Problem

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May 19, 1996

Abstract: The steam-boiler control specification problem is solved using evolving algebras, illustrating how this approach to the specification, design, and verification of complex systems can be used for a reliable, systematic and well documented development of executable code. A hierarchy of stepwise refined abstract models is developed, the ground version of which can be shown to faithfully reflect the informally given problem. The given informal problem description is formalized by a sequence of mathematical models which leads to a C++ program. This program has been demonstrated during the Dagstuhl-Meeting on Methods for Semantics and Specification, in June 1995, to control the FZI Steam-Boiler simulator satisfactorily.

The models are evolving algebras and thereby have a rigorous semantical foundation. They are related by stepwise refinement. The most abstract model is a *ground model*, i.e. the result of a formalization process of the informally given description which remains conceptually and notationally as close as possible to the latter and thereby can be inspected by the user for its adequacy. Some typical sample properties of the system are formalized and proven, under precisely stated assumptions, in the abstract models. We thus provide insight into the structure of the system and into useful directives for the definition of provably correct refinement steps leading to executable code.

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