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Formalizing the Context in Computational Mathematics

The set of vocabulary, background assumptions, and rules that govern an application of mathematics is called its *context*. The context of an application in deductive mathematics is traditionally formalized as an *axiomatic theory* in which mathematical knowledge is represented declaratively as a set of *axioms*. The context of an application in computational mathematics is often formalized as an *algorithmic theory* in which mathematical knowledge is represented procedurally as a set of *algorithms*. The background assumptions of an algorithmic theory and the specifications of the algorithms are usually not an explicit part of an algorithmic theory.

As a result, an algorithmic theory can be used to perform computations, but it cannot be used to understand what the results of the computations mean. A *biform theory* can represent mathematical knowledge both declaratively and procedurally. In particular, it can include algorithms equipped with precise specifications of their input-output relationships. In this talk, we will explain what a biform theory is and how a biform theory can be used to formalized the context in computational mathematics. We will also briefly introduce Chiron, a general-purpose logic based on set theory that is especially well-suited for expressing biform theories.