Quantitative Verification:
Formal Guarantees for Timeliness,
Reliability and Performance

David Parker

School of Computer Science,
University of Birmingham, UK

Abstract. Quantitative verification is a technique for analysing quantitative aspects of a system's design, such as timing, probabilistic behaviour or resource usage. It provides a means of automatically deriving formal guarantees on a wide range of system properties, such as timeliness, reliability or performance, for example, "the airbag will always deploy within 20 milliseconds after a crash" or "the probability of both sensors failing simultaneously is less than 0.001". Recent years have seen significant advances in the underlying theory, verification techniques and tool support in this area, and these methods have been applied to an impressive array of systems, from wireless networking protocols to robotic systems to cardiac pacemakers.

This talk will give an overview of the state-of-the-art in quantitative verification, focusing in particular on probabilistic model checking, a quantitative verification technique for the analysis of systems with stochastic behaviour. The talk will explain the key ideas behind the approach, highlight some of the application areas where it has been successful, with particular emphasis on case studies with industrial involvement, describe a few of the current research directions in the area and discuss some of the challenges which remain.