Modern applications running on today's embedded systems have very high requirements. Most often, these requirements have many dimensions: the applications need high performance as well as flexibility, energy-efficiency as well as real-time properties, fault tolerance as well as low cost. In order to meet these demands, the industry is adopting architectures that are more and more heterogeneous and that have reconfiguration capabilities. Unfortunately, this adds to the complexity of designing streamlined applications that can leverage the advantages of such architectures.

In this context, it is very important to have appropriate tools and design methodologies for the optimization of such systems. This thesis addresses the topic of hardware/software codesign and optimization of adaptive real-time systems implemented on reconfigurable and heterogeneous platforms. We focus on performance enhancement for dynamically reconfigurable FPGA-based systems, energy minimization in multi-mode real-time systems implemented on heterogeneous platforms, and codesign techniques for fault-tolerant systems.

The solutions proposed in this thesis have been validated by extensive experiments, ranging from computer simulations to proof of concept implementations on real-life platforms. The results have confirmed the importance of the addressed aspects and the applicability of our techniques for design optimization of modern embedded systems.