



# Scheduling and Certification of Mixed-criticality Systems

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## Context and Motivation

This research addresses issues arising from the convergence of two important trends in embedded systems:

1. Many safety-critical applications are subject to **certification requirements**.
2. There is an increasing trend towards **integrated architectures** that support multiple functionalities, often of different **criticalities**, upon a single computing platform.

As such systems become increasingly more complex, obtaining required certifications becomes more challenging. This project investigates the following **thesis**:

*Scheduling theory in its current form is unsuited to the design of mixed-criticality (MC) systems that are subject to multiple certification requirements; efficient resource use in such systems requires the development of fundamentally new scheduling techniques.*

## Methodology

The methodology adopted in investigating this thesis is to first **identify major weaknesses** with current approaches, that render certification cumbersome. Once these weaknesses are understood, **new models are proposed** for representing MC systems, and **metrics derived** for quantifying the effectiveness of techniques for building these systems. A **systematic study of resource allocation and scheduling** issues in certifiable systems is then conducted, aimed at providing quantitatively superior resource allocation methodologies.

## Outcomes

We expect that the outcomes of this project will enable embedded safety-critical systems designers to provide systems that make far more efficient use of platform resources than is currently possible, and that pass certification at a significantly lower cost.

## Project Members

James Anderson, professor  
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## Collaborators

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## Related Publications

Sanjoy Baruah, Haohan Li, and Leen Stougie. "Towards the design of certifiable mixed-criticality systems." *Proc. of the IEEE Real-Time Technology and Applications Symposium (RTAS)*, Stockholm, Sweden. April 2010. IEEE Computer Society Press.

Sanjoy Baruah, Haohan Li, and Leen Stougie. "Mixed-criticality scheduling: improved resource-augmentation results." *Proc. of the ISCA International Conference on Computers and Their Applications*, Honolulu, Hawaii. March 2010.

Malcolm Mollison, Jeremy Erickson, James Anderson, Sanjoy Baruah, and John Scoredos. "Mixed-Criticality Real-Time Scheduling for Multicore Systems." *Proc. of the 7th IEEE International Conference on Embedded Systems and Software (ICISS)*, Bradford, UK. June, 2010. IEEE Computer Society Press.

Sanjoy Baruah, Vincenzo Bonifaci, Gianlorenzo D'Angelo, Haohan Li, Alberto Marchetti-Spaccamela, Nicole Megow, and Leen Stougie. "Scheduling real-time mixed-criticality jobs." *Proc. of the 35th International Symposium on the Mathematical Foundations of Computer Science (MFCS)*, Brno, Czech Republic. August 2010. Springer-Verlag.

Haohan Li and Sanjoy Baruah. "Load-based schedulability analysis of certifiable mixed-criticality systems." *Proc. of the 10th International Conference on Embedded Software (EMSOFT)*, Scottsdale, AZ. October 2010.

## For More Information

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