Caccamo's real-time expertise benefits CSL's aviation research

Reliable and High Performance Computing

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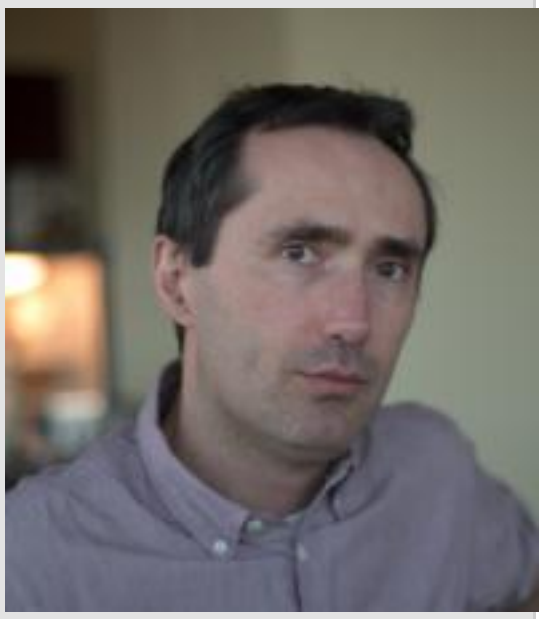
Computer Science Professor Marco Caccamo is no stranger to Illinois – he's been a professor here for almost 15 years – but only recently joined CSL as a faculty member.



Marco Caccamo

Caccamo's research focuses on real-time operating systems, real-time scheduling and real-time networks, with an emphasis on avionics and automotive systems. He is the principal investigator in the Real Time System Laboratory in Siebel Center and is now part of the reliable and high performance computing group in CSL.

Two years ago, Caccamo started to investigate real-time and robustness problems in the software of unmanned aerial vehicles (UAVs), which led to a natural connection with CSL.

"Working on UAVs is very interdisciplinary work which requires experts in controls, signal processing, software reliability and software security to name a few, and CSL has a lot of this expertise," he said. "I felt that this was right in the sense that I can grow this research in CSL."

Caccamo has worked on previous grants and projects with ECE Associate Professor Sayan Mitra, as well as ECE Professor Emeritus P. R. Kumar, and he feels he can most contribute in the area of real-time systems expertise.

"I've worked a lot with the traditional avionics industry in the past, as well as the auto industry and I still do that, but I see my research also going in a new direction," he said. "It sets new difficult challenges for me, such as addressing safety and security requirements, as well as power and weight constraints. I have in mind the goal of delivering robust, real-time and high performance computing capabilities to this new generation of airborne vehicles. I can't do this alone because it's just too big of a problem."

Outside of UAVs, Caccamo's research has focused heavily on multicore embedded platforms. Specifically, he studies how avionics and the automotive industry can transparently migrate their software to this hardware and how to design next generation real-time operating systems that can run safety-critical and real-time applications on multicore.

"Basically we're investigating how the embedded industry can safely and reliably take advantage of these multicore platforms that are broadly used for general purpose applications, but in avionics and automotive systems, we have just started," Caccamo said.

Caccamo notes that the delay in adopting multicore platforms in safety-critical embedded systems is because of the new challenges it introduces to the industry. For example, some features of multicore can cause unpredicted interference and delay between the applications executing simultaneously on the separate cores. This interference has actually been observed in laboratory during testing.

For the avionics and automotive industry, Caccamo is working to develop a technology called Single Core Equivalence (SCE). SCE is a framework of OS-level techniques that strictly partition the shared resources on the chip so that each core can be treated as an isolated single-core.

"The idea is that, from the point of view of an applicative software, a multicore system should behave like a traditional single core one," Caccamo said. "The ultimate goal is to reuse standard certification and design processes that have already been adopted by the industry for single core."

The core technology for SCE has already been developed, but there are still challenges to address in order to deliver a complete SCE framework to the industry, he said.

Caccamo received his Ph.D. in computer engineering from Scuola Superiore Sant'Anna, Pisa, Italy in January 2002 and joined Illinois shortly after graduation, where he is a professor of computer science. He has authored/coauthored more than 80 refereed publications in real-time and embedded networked computing systems. He is currently a guest editor of the Journal of Real-Time Systems and the program chair of RTSS. He was previously program chair of RTAS and also served as both general chair of RTAS and Cyber Physical Systems Week (CPSWeek'11). He was also awarded an

NSF CAREER Award in 2003 and is a senior member of IEEE.

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