ERTS Congress - 11th edition from 1st to 2nd June 2022 - Toulouse

"Significant scientific advances are needed to cope with the increase, in number and sophistication, of malicious threats targeting critical infrastructures and systems"

Having participated in the organization of ERTS International Congress for several years, Mohamed Kaaniche is the Program Committee Chairman of this 11th scientific conference dedicated to embedded systems. During an interview, Mohamed Kaaniche has addressed the highlights of ERTS 2022 and unveils the main scientific topics that will be presented.

June 2022 will see the 11th edition of ERTS², what represents this scientific event dedicated to embedded systems compared to the other events in the same domain?

ERTS is now a well-established and a major cross-sector event for the research and practice of resilient and real-time embedded critical systems. It is a unique bi-annual forum that has gathered, since its first edition in 2002, researchers, engineers and professionals from a wide variety of application domains, for more than two decades, to address timely challenges related to the design, validation, assessment and operation of embedded critical systems and applications, and to reflect on key future trends.

The organization of this event strongly relies on the active contribution of key industry partners from avionics, space and automotive domains which are the core application domains of this conference (Airbus, Continental, Renault, Thales, …), together with researchers from major research labs of the Occitanie Region addressing critical systems (LAAS-CNRS, ONERA, IRIT,…) as well as from the IRT Saint-Exupery.). The Congress is co-organized and supported by two major associations: 3AF, the Association of Aeronautics and Astronautics in France, and SEE, the Society for Electricity, Electronics and Information ad Communications Technology. The organization committee is supported by an international Program committee composed of a hundred of members from different countries (Austria, Finland, France, Germany, Italy, Japan, Netherlands, Portugal, Spain, Sweden, UK. I would like also to acknowledge the support of our sponsors (AdaCore, Airbus, ANITI, Continental) and partners (Aerospace Valllley, ISAE-Supaero, ONERA).

This year, the program committee has selected 47 contributions that will be presented as regular paper and talk and 12 as short paper and talk (with a poster).

Which main trends of embedded systems will be present in ERTS² 2022?

Critical embedded systems are deployed in several industrial application sectors such as transportation (avionics, automotive, railways ...), industry 4.0, space, healthcare, energy, smart cities, etc. Such systems are required to deliver trustworthy, resilient and timely services while achieving high levels of performance at the lowest costs. Achieving such requirements requires the development of innovative solutions to address various challenges raised today. We can mention first the need to investigate the impact of the new technological trends that include the advent of multi-core, many core and GPU processor architectures, as well as virtualization and edge computing techniques with the development of new services based on a more advanced distribution of processing and storage on remote infrastructures, using in particular Internet of Things (IoT) and advanced communication technologies (5G, etc.). These evolutions have led to increasing the complexity of the systems, as well as the risks of failures or degradation of performances that result from accidental causes or malicious attacks.

Another major challenge is related to the growing interest in integrating artificial intelligence algorithms into mission-critical applications in order to achieve increasing levels of autonomy, flexibility and adaptation to changes and unforeseen events. The current state of knowledge does not allow yet to provide the minimum levels of guarantees and justified confidence required for the certification of systems integrating such algorithms for mission critical domains. A major goal of current research is to develop innovative solutions for the problem of establishing guarantees of reliability, security, safety, robustness and better explainability for systems that incorporate increasingly complex machine learning models, and for the challenge of determining whether such systems can comply with requirements for safety-critical systems.

Cybersecurity is another challenging area where significant scientific advances are needed to cope with the increase, in number and sophistication, of malicious threats targeting critical infrastructures and systems. Vulnerabilities span all system layers, and increasingly the lower layers and the hardware. The Spectre and Meltdown vulnerabilities identified in Intel processors are recent examples. Hardware assisted protection techniques and trustworthy embedded components are among the promising solutions being explored, together with new paradigms that consider security and safety holistically.

Several sessions of this year program address these challenges, besides the traditional topics addressed at ERTS such as model driven and rigorous engineering, assurance & certification, and verification and testing. In addition, the program features two keynotes from two distinguished speakers. The first keynote by Ahmad-Reza Sadeghi, TU Darmstadt, Germany, will address the challenges for building trusted computing architectures capable of facing hardware vulnerabilities and cross layer attacks. The second keynote by Andreas Graff, Continental Automotive, Germany, will focus on the current trend of automotive embedded computing architectures towards the use of

software defined technologies and edge computing and discuss related design challenges and solutions.

A panel gathering different industrial end-users and experts of processor architectures, high-performance computing, and timing analysis will discuss the new trends in terms of processors and computing platforms for embedded systems and how to master the current evolution towards increasing integration and performance and decreasing energy consumption to reach safety and security objectives at sustainable costs.

Which place will have artificial intelligence?

The integration of artificial intelligence algorithms into critical systems to achieve increasing levels of autonomy is a timely and hot topic that is addressed in several papers in this year program. Although machine learning algorithms have demonstrated high accuracy for specific tasks such as object recognition and classification, several questions are raised regarding the minimum level of justified confidence and assurance that can be achieved or demonstrated for the certification of systems integrating such algorithms. Indeed, machine learning (ML) algorithms are typically based on the assumption that the training dataset is representative of the inputs that the system will face during its deployment. However, in practice there are a wide variety of unexpected accidental, as well as adversarially-crafted, perturbations on the ML inputs that might lead to violations of this assumption. Furthermore, ML algorithms are often run on special-purpose hardware accelerators, which may themselves be subject to faults. A major goal of current research is to develop innovative solutions for the problem of establishing guarantees of reliability, security, safety, robustness and better explainability for systems that incorporate ML models. As an example, the challenge of reconciling safety objectives with machine learning performance is in particular tackled in one of the papers presented this year. Another paper addresses the difficult problem of dataset exploration and cleaning of mislabeled inputs in the training samples. An avionics use case illustrating the problem of building assurance cases for systems integrating ML algorithms to comply with the EUROCAE WG-114/SAE G-34 ongoing standardization framework is another example of relevant contribution presented in the program. Finally, the use of AI algorithms to estimate memory interference impact on avionics software on multicore platforms provides another perspective linked to AI.

Since its creation in 2002, you have participated in many editions of ERTS, how do you perceive its evolution?

As I mentioned earlier, ERTS is now a well-established and a major cross-sector event for the research and practice of resilient and real-time embedded critical systems. This event is well appreciated both by industrial and academic partners as it provides a unique cross-fertilization forum for addressing timely challenges with both practical and fundamental research relevance of common interests to different application domains (avionics,

ERTS 2022
11th EDITION EUROPEAN CONGRESS

NEW DATES
1-2 JUNE, TOULOUSE - FRANCE
DIAGORA CONGRESS CENTER

EMBEDDED
REAL TIME SYSTEMS

3AF   **see** since 1883

automotive, space, ...). Historically, ERTS initially focused on real-time critical software and associated engineering and assessment methods and tools. The scope has later broadened to cover system architecture and engineering perspective, including software -hardware interactions and the challenges of achieving safety and certification requirements. The most recent evolution of topics addressed at ERTS is in line with critical systems industry requirements for more resilient and autonomous systems, exploring in particular artificial intelligence techniques. The joint organization of this event by both industry and academic partners at different levels (chairmanship, Organization committee, Program committee with several members from different countries) is also a major asset of ERTS.

You are now at the Head of LAAS-CNRS, how do you evaluate the importance of embedded systems sector at European level and the place of ERTS in this context?

The potential of embedded systems technologies and applications remains high with growing strategic importance of this area. This importance is further strengthened with the development and advances of IoT technologies and edge computing paradigms. There are several areas where Europe is strong and where the use of embedded technologies in the systems is essential. This is particularly the case in areas where safety and reliability are critical requirements in the control of large systems, e.g., transportation (avionics, automotive, etc.), healthcare, environment, energy, and communications. It is also the case for smart industries and robotics. The growing interest for AI technologies will also open new opportunities for research, innovation and economic development. We have several assets in these areas, in France and in Europe, with key industry leaders and research labs. ERTS as a cross-sector forum for discussing technological trends, challenges and solutions in these areas contributes to this effort and to Europe's visibility by disseminating recent scientific research results and industrial solutions.

REGISTRATION IS OPEN: www.erts2022.org

About ERTS[2]

ERTS² is a high-level event, held every two years, for universities, research centres and industry. The 11th edition of this unique event in Europe for manufacturers and researchers in the sector of embedded systems and software, co-organized by 3AF (Association of Aeronautics and Astronautics of France) and the SEE (Society of Electricity, Electronics and Information and Communication Technologies) will take place from 1st to 2nd June 2022 at the Diagora Congress Center in Toulouse.

For further information: https://www.erts2022.org/index.html

About the Aeronautics and Astronautical Association of France (3AF)

Created in 1972 is a French aerospace society. Its mission is to advance the aerospace profession, stimulate progress in the state of the art or aerospace science and technology and represent the profession in public policy discussions. Unite, share, enlighten and advance: 3AF is a forum for knowledge exchange. Unite a network of more than 1500 members, 60 companies from the scientific aerospace community. Share 10 international conferences and symposiums per year, experts publications. Enlighten a scientific society, an expert pool of knowledge consulted by decision makers and media. Advance 20 technical commissions which contribute to advancing the aerospace industry.

About the Society of Electricity, Electronics and Information and Communication Technologies (SEE)

SEE (Société de l'Électricité, de l'Électronique et des Technologies de l'Information et de la Communications) is a nonprofit, state-approved, scientific and technical society, active in France since 1883. It aims to bring together individuals and corporations interested in science and technology and in the progress of theories, practices and applications in the areas of energy, electronics, information technology and communications, aerospace, auto, transport, and biomedical applications. Through its close relationships with major public utilities, with university and industry, through its links with other French and foreign associations of the same type, SEE actively contributes to the promotion of its field of activity and offers its members opportunities for particularly fruitful meetings and exchanges.

Press contacts :

Juslan Lo
Tel. +33 5 6348 6431
jlo@univ-jfc.fr

Laurent Mangane
Tel. +336 3114 3877
l.mangane@arcor.de