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PROXY APPLICATION DEVELOPMENT: DISCRETE MATHEMATICS-INDUSTRIAL SYNERGIES TO MEET SUSTAINABILITY CHALLENGES AND FOSTER INNOVATION

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ABSTRACT

Proxy applications are simplified models capturing the essential behaviour of critical algorithms, operations, data communication patterns and layout in workload phases of interest of application codes or science workflows. Proxy apps have emerged as essential tools for advancing computational science in academia and industry and are a critical component of Exascale and post-Exascale initiatives such as EuroHPC, InPEx and the French NumPEx. Proxy apps offer industrial actors a valuable platform for improving performance, optimizing design processes, ensure interoperability and performance of critical software components and tools in an evolving high-performance computing (HPC) environment. They allow exploring new programming and execution models, code and performance portability issues and performance evaluation methodologies.

This invited session explores the development and deployment of well-documented and well-curated proxy apps, highlighting the convergence of mathematical and algorithmic considerations with industry needs, and their role in driving co-design innovation in HPC. A key focus is the interplay between academic initiatives and their applicability to use cases, paying special attention to high-level abstraction, programmable layers and domain-specific languages (DSLs) and their adoption the industry. Special attention will be given to advancements in computational technologies, (large-scale AI, hybrid exascale computing…) that are expanding the potential of proxy apps and will open new avenues for scientific research and industrial applications.

Examples of applications include the energy industry, where proxy apps underpin large-scale CO2 storage simulations and renewable energy systems, automotive and manufacturing, health and medical sciences where they assist in testing new materials and designs, and many other instances where proxy apps help accelerate innovation cycles. Their role also spans areas such as computational tools for urban planning, climate modelling, infrastructure optimization, sustainable transport, mobility and more.

Attendees will highly benefit from this invited session, gaining insight into the future of proxy apps, their role in addressing industrial and environmental challenges, and their benefits and impacts in their day-to-day work.

References:

1. Bergman, K., et al. "Exascale computing study: Technology challenges in achieving exascale systems." Defense Advanced Research Projects Agency (2008).
2. Matsuoka, S., et al. “Preparing for the Future - Rethinking of Proxy Applications”. Computing in Science & Engineering, 24, 85-90 (2022), doi: 10.1109/MCSE.2022.3153105