**NUMEXAS**

**Body:**

**Motivation**

Exaflop computing will make a considerable impact on several areas of engineering and applied sciences, where current high-end computing capabilities are deemed grossly insufficient. The overall aim of the NUMEXAS project is to develop, implement and validate the next generation of numerical methods to be run under exascale computing architectures. This will be done by implementing a new paradigm for the development of advanced numerical methods to really exploit the intrinsic capabilities of the future exascale computing infrastructures. The project covers RTD activities along the complete simulation pipeline: parallel pre-processing and grid generation, new numerical methods for parallel structured/unstructured multidisciplinary field solvers of high order, optimum design parallel solvers considering uncertainties and parallel in-solver visualization and feature extraction. The new numerical methods and software will be validated for a selected number of exascale size problems in engineering and applied sciences in state-of-the-art high performance computing platforms. The main outcome of NUMEXAS will be a new set of numerical methods and codes that will allow industry, government and academia to solve exascale-class problems in engineering and applied sciences in the next generation of exaflop computers with the efficiency and ease of use as today’s state-of-the-art codes. The consortium has a well-balanced distribution of institutions specialized in the development of numerical methods to solve grand challenge engineering and scientific problems (CIMNE, LUH-IKM and NTUA) and institutions hosting HPC facilities and supercomputing infrastructures (CESCA and LUH-HLRN). The partnership is completed with QUANTECH, an SME specialized in the development and marketing of simulation software for industrial forming processes.

The overall aim of NUMEXAS is therefore to develop, implement and demonstrate the next generation of numerical simulation methods to be run under exascale computing architectures. This cannot be done by just scaling currently available codes, but by implementing a new paradigm for FP7-611636 – NUMEXAS Collaborative Project the development of advanced numerical methods to really exploit the intrinsic capabilities of the future exascale computing infrastructures. The specific goal of NUMEXAS is the development of numerical methods for multi-physics problems in engineering based on validated models that enable scaling to millions of cores along the complete simulation pipeline.

**Challenges & Highlights**

The major challenge in NUMEXAS will be the development of a new set of numerical methods and computer codes that will allow industries, governments and academia to routinely solve multidisciplinary large-scale class problems in applied sciences and engineering with high efficiency and simplicity. We strive to demonstrate good scalability of up to several tens of thousands of cores in practice and to predict the theoretical capability of significant further performance gains with even higher orders of numbers of cores.

**Potential applications & future issues**

The NUMEXAS methods and codes will be the main project outcomes that will be disseminated and exploited by the partners. Emphasis will be put in the dissemination and exploitation of the NUMEXAS outputs among SMEs in Europe.

**Project abstract:**

Exaflops computing will make a considerable impact on several areas of engineering and applied sciences, where current high-end computing capabilities are deemed grossly insufficient. The overall aim of the NUMEXAS project is to develop, implement and validate the next generation of numerical methods to be run under exascale computing architectures.

**Logo:**

NUMEXAS
Project manager: Prof. Dr.-Ing. Gabriele von Voigt
Project research areas: Exascale High Performance Supercomputing in Applied Science

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