idw - Informationsdienst Wissenschaft
Nachrichten, Termine, Experten

Press release

Fraunhofer-Institut für Algorithmen und Wissenschaftliches Rechnen SCAI
Dipl.-Journalist (TU Dortmund) Michael Krapp

01/03/2011
http://idw-online.de/en/news403181

Research projects, Transfer of Science or Research
Information technology, Materials sciences, Mathematics
transregional, national

Computing on multiple graphic cards accelerates numerical simulations by orders of magnitude

The Fraunhofer Institute for Algorithms and Scientific Computing SCAI, in conjunction with the Institute for Numerical Simulation (INS) at the University of Bonn have been selected as one of the first CUDA™ Research Centers in Germany based on the vision, quality and impact of their work. The research will emphasize the development of massively paralleled multi-GPU based software packages for numerical simulation in the Natural and Engineering Sciences. Companies will benefit from the transfer of knowledge from basic research to practical applications.

SANKT AUGUSTIN / BONN Because of their leading research in numerical simulation using parallel computing practices, the Fraunhofer Institute for Algorithms and Scientific Computing SCAI and the Institute for Numerical Simulation (INS) at the University of Bonn have officially become one of the first German NVIDIA CUDA Research Centers. The research on parallelization of existing simulation codes to run on machines with multiple graphics processing units (GPUs) is led by Prof. Dr. Michael Griebel, director of the INS and director of the Fraunhofer Institute SCAI.

"Our vision is to develop a massively parallel, completely multi-GPU based high performance molecular dynamics software package, as well as a massively parallel, completely multi-GPU based high performance fluid dynamics code," says Griebel. "Our customers from industry and research institutes will profit from our ability to solve general challenges of high-performance computing in this way."

Today, numerical simulations are indispensable in industrial production. Examples are the creation of new materials, the modeling of manufacturing process chains, and the simulation of material strength and fluid dynamics. However, these simulations require computing times from hours to days – even on high performance computers. This is why industry and science are very interested to shorten processing times.

Computing on multiple graphics cards promises an enormous acceleration of these simulations. NVIDIA's CUDA parallel computing architecture, enables a dramatic increase in computing performance by harnessing the tremendous power of the GPU. Especially for software that is well suited for parallel computing, the graphics processor is faster than conventional CPUs by orders of magnitude. For example, the INS successfully ran the fluid solver package NaSt3DGPF on eight traditional processors coupled with eight graphics processors. Performing a benchmark study showed that the multiple GPU configuration was even slightly faster than a system using 256 conventional processors.

The researchers from INS and SCAI hope to gain similar effects from adapting the software package Tremolo-X for use on multiple graphics cards. Tremolo-X is used for the molecular dynamics of atoms or molecules. This software simulates materials at the nano scale, and therefore makes it possible to efficiently design new and innovative materials.

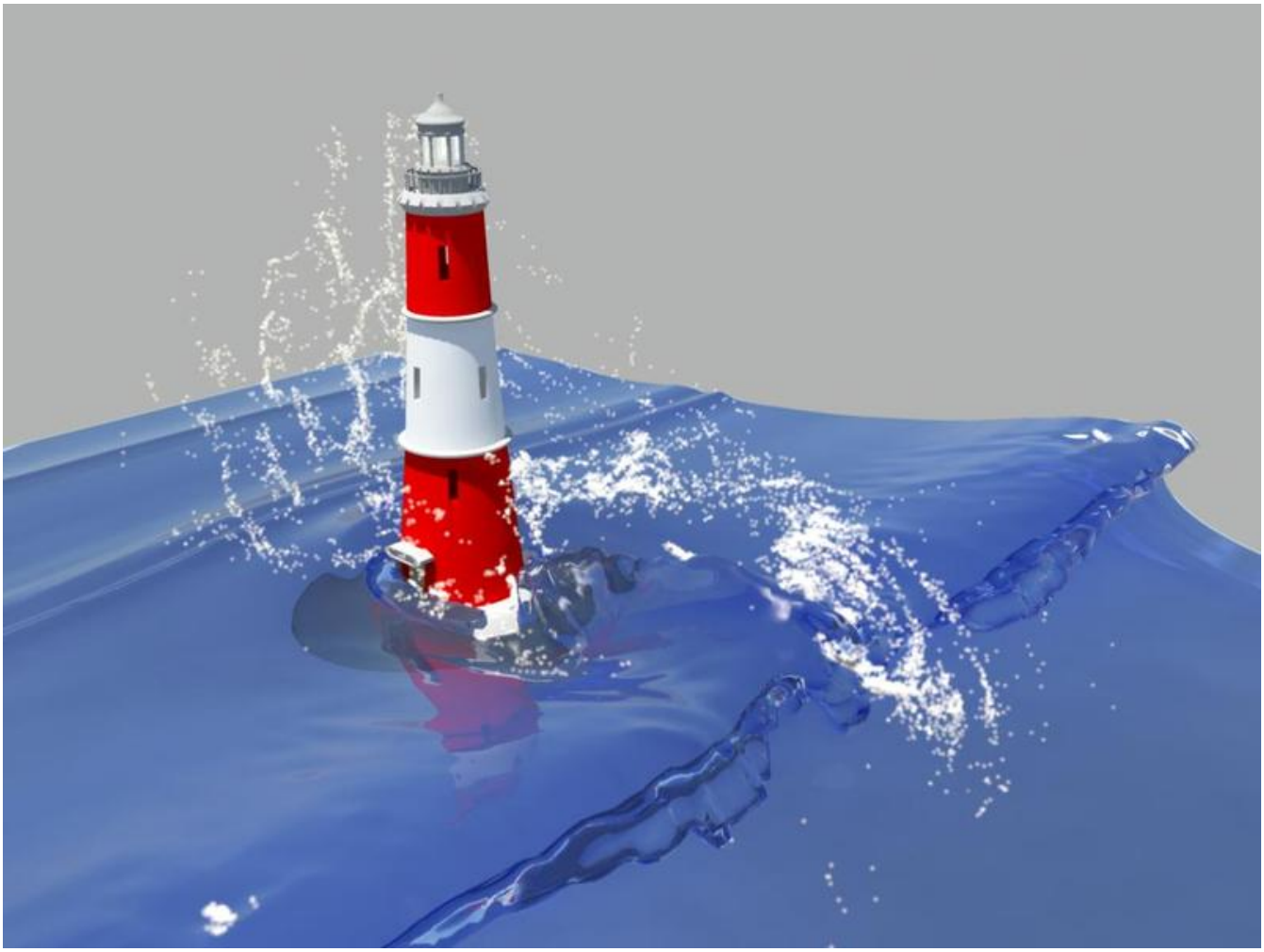
Computing on graphics cards not only promises an enormous acceleration of numerical simulations. The GPUs also require much less electricity, delivering a much higher performance per watt benefit. A particular computing task on a conventional parallel computer with 256 processors uses up to 70 kilowatts, compared to only 3 kilowatts on the machine with multiple GPUs. Furthermore, companies profit from GPU computing because the hardware is cheaper.

About Fraunhofer SCAI:
The Fraunhofer Institute for Algorithms and Scientific Computing SCAI conducts research in the field of computer simulations for product and process development, and is a prominent corporate partner in the industrial and science sectors.
SCAI designs and optimizes industrial applications, implements custom solutions for production and logistics, and offers calculations on high-performance computers. Our services are based on industrial engineering, combined with state-of-the-art methods from applied mathematics and information technology.
www.scai.fraunhofer.de

About the Institute for Numerical Simulation:
The Institut für Numerische Simulation of the Rheinische Friedrich-Wilhelms-Universität Bonn is devoted to the design and implementation of computational tools for scientific applications. We develop novel numerical techniques for the simulation of e.g. chemical, physical, engineering and economic processes. Our research and development activities are application driven.
The INS's core competencies include high performance scientific computing, numerical mathematics, computational chemistry and physics, as well as financial engineering. We conduct collaborative scientific investigations which require the power of high performance computers and the efficiency of modern computational methods.
www.ins.uni-bonn.de

About NVIDIA:
NVIDIA (NASDAQ:NVDA) awakened the world to the power of computer graphics when it invented the GPU in 1999. Since then, it has consistently set new standards in visual computing with breathtaking, interactive graphics available on devices ranging from tablets and portable media players to notebooks and workstations. NVIDIA's expertise in programmable GPUs has led to breakthroughs in parallel processing which make supercomputing inexpensive and widely accessible. The Company holds more than 1,600 patents worldwide, including ones covering designs and insights that are essential to modern computing. For more information, see www.nvidia.com.

URL for press release: http://research.nvidia.com/content/fraunhofer-unibonn-crc-summary



Two-phase fluid flow with coupled particle droplets
© M. Griebel, P. Zaspel (Institute for Numerical Simulation, University of Bonn)

Logo of the CUDA research center