Digitization

The amount of data in many companies is growing rapidly; processing and analyzing it is becoming a key competitive skill. Our researchers support companies in building up know-how and developing solutions in business processes, production and logistics. We attach great importance to feasibility, cost-effectiveness, data protection and security.

EU Project OPTIMA Accelerates Industrial HPC Applications

The main goal of the completed EU project OPTIMA was to optimize and test industrial applications and open source libraries on HPC systems with FPGA chips. These special chip technologies, known as field-programmable gate arrays (FPGAs), accelerate certain applications that are executed on a supercomputer. Research work from the MESHFREE and CARME groups has been incorporated into the project.

FPGA chip technologies are known for their lower power consumption compared to CPUs and GPUs. It therefore makes sense to use them for energy-intensive calculations such as simulations. "OPTIMA gave us the opportunity to test whether FPGA-controlled approaches are generally suitable for our simulation software MESHFREE and how we need to adapt them so that our simulations run faster on FPGA chips," says Sebastian Fett, who worked on the project for the Transport Processes department.

Challenge: Complex Algorithms From MESHFREE

The researchers use MESHFREE to simulate complex flow processes such as the passage of a car through water. "Due to the wide variety of applications and the complexity of our algorithms, very large amounts of data are generated that have to be transferred to the FPGA environment. This led to a bottleneck," explains the computer scientist. In addition, MESHFREE is based on code that has grown over a long period of time and had to be restructured before the data could be ported to FPGAs. Nevertheless, he and his team believe that speed increases using FPGAs in an adapted version of MESHFREE are realistic.

Carme Framework Extended

Researchers from the HPC department were also involved in OPTIMA. With the help of their open-source framework Carme, multiple users are able to manage available computing resources without prior knowledge of workload management tools such as Slurm. The graphical user interface enables interactive access to hardware resources.

"We have provided support for GPUs in Carme right from the start; the integration of FPGAs was previously missing from the Carme framework," says Dr. Matthias Balzer, describing his department's motivation for participating in OPTIMA. "During the course of the project, we integrated the essential components for FPGA support into the framework. The available accelerators, i.e. both GPUs and FPGAs, can be conveniently selected via the Carme web frontend." In addition, a simple prototype of an FPGA kernel library for machine learning was implemented.

www.itwm.fraunhofer.de/meshfree_en

www.itwm.fraunhofer.de/carme-en

Contact

Dr. Matthias Balzer
Division "High Performance Computing"
Phone +49 631 31600-4579
matthias.balzer@itwm.fraunhofer.de

Kontakt

M. Sc. Sebastian Fett
Department "Transport Processes"
Phone +49 631 31600-4018
sebastian.fett@itwm.fraunhofer.de

From Excel to the App: Data Science in Real Estate Financing

Real estate financing is a key area of business for many insurance companies. The financing of both commercial and private real estate involves a flood of sometimes manual processes, from the initiation of business to risk management. Intelligent digitalization and automation can save immense costs. This is demonstrated by researchers from the Financial Mathematics department in a project with R+V Versicherung.

R+V Versicherung is active as a lender in the construction sector; on the one hand, it grants loans for private residential property, but also finances commercial real estate such as shopping centers or office buildings. In risk controlling, suitable forecasting methods help to estimate the probability of loan default. To do this, the insurer wants to know how repayments will be made. "Fixed repayment installments are relatively easy to predict. Statistical methods can be used to include unscheduled repayments, terminations or deferrals in the forecast. If sufficient data is available, machine learning methods can also provide a better prediction," explains Dr. Jörg Wenzel, Head of the Financial Mathematics department.

Dashboards for Commercial Real Estate Financing and Individual Transactions

The basis of every good forecast is as much data as possible. Until now, banks and insurance companies have often recorded and processed this data in Excel. In the new app, which is being developed together with the Fraunhofer ITWM, all relevant data on real estate financing is brought together in a database and made usable via a dashboard. R+V Versicherung employees now have a tool with which they can quickly create, process, evaluate and analyze business transactions.

The entire financing portfolio can be viewed at the click of a mouse and the app can support the creation of annual reports and management reports. Users are also positive about the app's much more user-friendly interface.

"Furthermore, we support the development of an app that includes a variety of visualizations in the form of graphs or tables," says Wenzel. These help to provide a compact overview of large volumes of complex data and ultimately support important business decisions. For example, the visualizations enable a comparison of competitors over time or a customer overview with regard to various criteria.

www.itwm.fraunhofer.de/asset-allocation-portfolio-optimization-en

Contact

Dr. Jörg Wenzel
Head of Department "Financial Mathematics"
Phone +49 631 31600-45015
joerg.wenzel@itwm.fraunhofer.de

Effective Procurement Strategies for Energy Trading

Trading and procuring electricity and gas are key areas for energy suppliers. Many of these companies rely on digitalization, automation and artificial intelligence to meet the increasingly complex requirements of politics and business. In collaboration with SWK Stadtwerke Kaiserslautern GmbH, our "Financial Mathematics" department has analyzed and optimized procurement strategies in the "Dynamic Optimization of Trading Strategies" project. With complete success – because the researchers developed a prototype and want to continue working together.


© freepik

With the increasing expansion of renewable energies, it is essential for suppliers to be flexible. They must be able to react dynamically to market movements and change their procurement strategies at short notice. However, this requires reliable systems that effectively support and profitably assist strategic decision-making.

This is where the work of our researchers begins. Their expertise includes mathematical modelling of energy markets, risk management, the optimization of trading strategies and the associated software development. They combine mathematical analysis and modeling with concrete implementation in software in order to offer practical solutions for various challenges. This combination makes the Fraunhofer ITWM a strong partner for a wide variety of problems.

Successful Cooperation on Site

This was also the case in the project with the Kaiserslautern-based energy supplier. "Here, we worked on the analysis and validation of procurement strategies and carried out various optimizations of the strategy using different evaluation criteria," explains project manager Christoph Gärtner. The result is a software prototype that presents the results of our research in a user-friendly way and at the same time allows users to carry out their own optimizations. However, the prototype also shows potential for further research in both energy trading and energy procurement. "We want to work on this together with our partner in a subsequent project. In this way, we are not only securing the future viability of energy suppliers, but also meeting the challenges of the energy transition. We look forward to continuing our cooperation," concluded Gärtner.

www.itwm.fraunhofer.de/flexible_loads

Contact

M.Sc. Christoph Gärtner
Department "Financial Mathematics"
Phone +49 631 31600-4114
christoph.gaertner@itwm.fraunhofer.de