News 2.25

Dear readers,
Our summer newsletter focuses on quantum computing. Here you can find out what the four Fraunhofer institutes in Hamburg are working on in this exciting field. We also report on the successful completion of a project dealing with shore-based decision support for autonomous ships. The TUHH and the Institute of Maritime Logistics have successfully completed another project. Read more about this in the guest article. I wish you a stimulating read!

Best regards
Yours, **Prof. Carlos Jahn**
Head of Fraunhofer CML

Quantum computing for Hamburg by Fraunhofer

The Hamburg Innovation Summit (HHIS), with its focus on creative and innovative companies from industry and research, is a platform on which the Hamburg Fraunhofer institutes present themselves together. Fraunhofer CML, ITMP, IAP and IAPT have joined forces to form the virtual "Fraunhofer Industrial Application Center Quantum Computing Hamburg" (Fraunhofer IQHH) under the theme of "Quantum Computing" in order to jointly develop solutions specifically for the maritime industry, drug research, development of innovative materials and additive production. The experts present exemplary solutions in a white paper: A complex routing problem is solved for maritime logistics, while drug development benefits from the quantum-accelerated optimization of central development steps. The optimal composition of high-performance platinum catalysts can also be specifically determined using quantum computing and additive manufacturing benefits from sensor-based weak point analysis using neural networks.

The institutes will also be showcasing other exhibits at the Innovation Summit: the Fraunhofer CML will be demonstrating image-based damage analysis on containers. The ITMP uses a 3D molecule model to show how drug research works and how small chemical lead structures become therapeutics. The IAP explains the use of nanoscale catalysts for the cost-effective development of new material surfaces. And the IAPT will show how additively manufactured components can be produced at the first attempt with the help of sensor data, digital twins and AI.

Hamburg Innovation Summit on July 10, 2025

Concrete use cases, many exhibits and, last but not least, our dedicated researchers await you from 10 am to 10 pm at the headquarters in the Gleishalle in the Oberhafenquartier. For example, Dr. Anisa Rizvanolli from the Fraunhofer CML will present the white paper on quantum computing in a panel from 2:30 pm to 3:15 pm.
The event is free of charge for all visitors. We look forward to your visit!

Quantum computing on the high seas: new solutions for maritime processes

Anisa Rizvanolli from the Fraunhofer CML and Nils Aden from the Harren Group presented the potential of quantum computing - i.e. the use of quantum mechanics for information processing - at our Maritime Innovation Insights (MII) event in May. The Harren Group operates around 60 ships that take on project cargo or are used for tramp shipping. These transport services are characterized by a high degree of flexibility, which results in highly complex route planning for the shipping company. In addition to the delivery of goods in agreed time windows, the speed of travel and its influence on fuel consumption and the margin of the transported goods are decisive for optimal route planning. For example, a higher speed can make economic sense despite higher fuel costs, as higher margins and possibly additional trips more than compensate for this. Today, the task of finding the optimum round trip is often solved by the experience of the employees. If further complex aspects (e.g. speed optimization) are to be evaluated or changes are required at short notice, the algorithmic search for optimal solutions can be advantageous. The additional use of quantum computing has the potential to significantly accelerate this solution finding process. Contact us and get ideas for your optimization problems from our specialists!

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Successful completion of the LEAS project: Artifical Intelligence supports traffic control centers in making decisions

In April, the Fraunhofer CML and its partners successfully completed the LEAS (Land-based Decision Support for Autonomous Ships) project. The aim was to develop, implement and evaluate an AI-based decision support system for traffic monitoring. Conventional and autonomous ships, including unmanned vehicles, were taken into account. This is because maritime transport routes are undergoing a transformation due to increasing digitalization and automation on board ships. Research is being conducted worldwide on partially, highly and fully automated and autonomous ships; prototypes are being developed and tested. However, the technical and operational integration of these new ships into the existing system of conventional ships and shore-based traffic monitoring services has so far received little attention. At the same time, staff shortages and rising traffic volumes are increasing the demands on traffic services, as they are increasingly confronted with more complex situations and delayed response times. These challenges underline the need for new solutions, such as the intelligent assistance systems developed in the Vessel Traffic Service (VTS) laboratory at the Fraunhofer CML. The components developed are based on artificial intelligence (AI) and are integrated into an innovative human-machine interface (HMI). This interface provides the operator with a transparent overview of the automated system's intentions and objectives as well as the information used. For example, automated traffic monitoring can detect developing collision risks, such as the collision between the Petra L and a wind turbine in the North Sea in April 2023, by analyzing historical traffic patterns and evaluating nautical charts and alerting VTS operators to imminent dangers in good time. In addition, the automated monitoring of VHF radio communication can also detect dangerous situations that are not immediately visible in the situation picture, which significantly reduces the workload for VTS operators. At the final project meeting on April 28 and 29 in Warnemünde, all project participants came together and presented the results. The consortium is already planning a follow-up project in which the knowledge gained will be integrated into a productive VTS system. The LEAS project is of great interest to authorities performing VTS tasks and manufacturers working on technologies for highly automated or autonomous ships.

LEAS: Decision recommendations for VTS with highly automated or autonomous ships using AI

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Combined transport: less emissions – more efficiency

The interdisciplinary research project BePoT – "Logistic Operating Curves for Gantry Cranes on Transshipment Terminals" – which was launched in August 2022 and completed in November 2024, was carried out by the Institute of Production Management and Technology and the Institute of Maritime Logistics at Hamburg University of Technology under the direction of Professors Hermann Lödding and Carlos Jahn.

Combined transport (CT) – the linking of road, rail and waterway – plays an important role in achieving Germany's sustainability goals by shifting long-distance freight transport from emission-intensive trucks to environmentally friendly rail and inland waterways. However, transhipment terminals continue to face challenges such as handling delays, operational inefficiencies and conflicting logistics objectives that affect the overall efficiency of combined transport. To address these issues, the BePoT team transferred the proven models of production logistics – throughput diagrams and logistical operating curves – to the operation of gantry cranes in CT terminals and developed a simple model-based planning and control system for truck arrivals. In addition, operational inefficiencies, corresponding improvement measures and their effects on the logistical objectives of CT terminals were investigated.

These tools provide terminal operators with a solid basis for reconciling short throughput times with high crane utilization and ultimately increasing handling capacity. The project has successfully demonstrated the effectiveness of throughput charts and logistic operating curves in analyzing and increasing gantry crane performance, thus contributing directly to the transition to low-emission transport.

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