The universal laser machine

On the verge of a new era in laser technology

Thanks to the great progress in the development of ultrafast lasers, it is now technically possible to set up lasers that can switch between cw and (ultrashort) pulsed operation at kW average power levels. The technology is ready and will allow us to perform most of the known laser applications with one and the same device. The prospect of performing everything from micro to macro materials processing with the same laser on one and the same machine bears enormous potential for digital manufacturing and is particularly attractive for small and medium-sized enterprises.

There are already promising demonstrations that combine additive manufacturing with high-precision ablation on one machine for example, but it will still take some significant research effort to realize the universal laser machine on which one can carry out all or at least most of the currently-known laser-based manufacturing processes. The needs are well understood though, and require especially novel approaches to system engineering and the integration of powerful machine learning.

The vision of a universal laser machine is being strongly promoted by the Institut für Strahlwerkzeuge (IFSW) at the University of Stuttgart and is also being successfully pursued within the Innovation Campus 'Mobility of the Future' (ICM). This has been established as a joint initiative with the Karlsruhe Institute of Technology, funded by the Baden-Württemberg Ministry of Science, Research, and Arts. Thanks to these efforts, a new professorship on laser systems engineering has been established at the IFSW in order to intensify the research activities required for the realization of universal laser machines as one key technology for digital manufacturing. The new professor will present his vision and planned research in a keynote speech during the opening session of the Stuttgart Laser Technology Forum (SLT 2022).

Together with many other exciting contributions, the SLT 2022 will once again give us an outlook into the future of laser technology and will highlight the current developments and achievements. The latest developments in laser sources will be discussed along with the latest advances in fiber-based beam delivery, optical scanners, and real-time process control. The materials processing applications to be presented range from high-precision drilling to the fundamentals of additive manufacturing, welding, and cutting. Special emphasis will be given to the x-ray emission generated when processing metals with powerful ultrafast lasers, and the legal and practical consequences.

I wish you inspiring reading of the current issue of PhotonicsViews!

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www.slt.uni-stuttgart.de