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Machine-learning supported shaping of laser pulses in a control loop

The central goal is the implementation of a neural network based self-learning loop, which connects advanced laser technology, an optimization algorithm, and an experimental feedback signal. The showcase example is the machine-learning supported compression of a femtosecond laser pulse to its Fourier limit, which is the lower limit for the pulse duration that can be technically realized for a given optical spectrum of the pulse. The corresponding experimental realization is the maximization of laser-frequency up-conversion, i.e. second-harmonic generation in a nonlinear optical crystal. The higher the recorded second-harmonic output signal is that serves as the feedback for the algorithm, the shorter the initial laser pulse is that interacts with the crystal. The optimization algorithm controls the pulse shaper hardware and proposes a new pulse that gives rise to another output signal, until convergence is reached. The summer student will join the team of experienced scientist working on the project to characterize convergence of optimal control algorithm with respect to the number of free variables, steering parameters and noise resilience.

Group

FS-PS-FCP

Project Category

A5. Lasers and optics

Special Qualifications

Programming experience

DESY Site

Hamburg

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