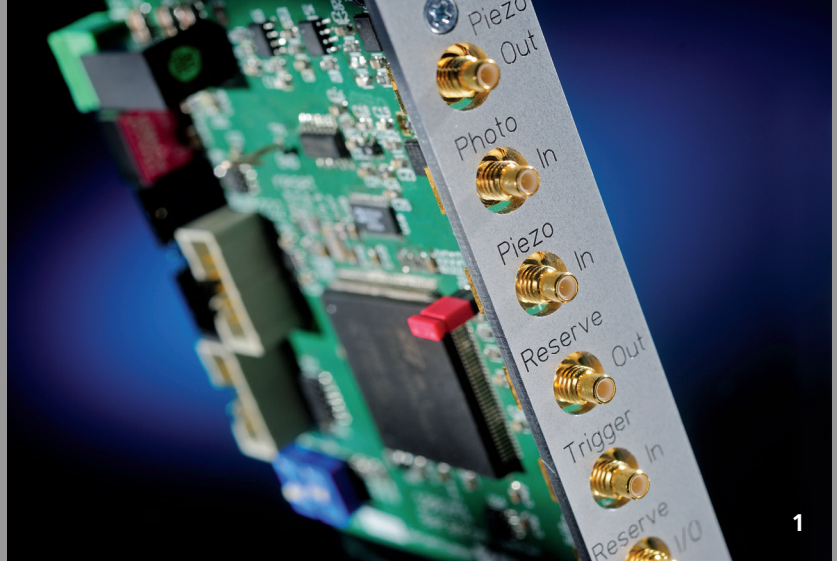

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ADAPTED CAVITY CONTROL PROCESS FOR A SINGLE-FREQUENCY OSCILLATOR

Task

For the laser transmitter of the satellite-based CH_4 IPDA system MERLIN, laser pulse pairs at 1645 nm are required in the longitudinal single mode (single frequency). For this purpose, a nonlinear frequency converter will be used, which has to be pumped with single-frequency laser pulses at 1064 nm. For the MERLIN instrument, a repetition rate of 24 Hz has been designed for laser pulse pairs. Single-frequency pulses for such applications are usually generated in Q-switched and injection-seeded oscillators. Here, the optical length of the resonator has to be actively adjusted, resonant at a multiple of the irradiated half laser wavelength at an accuracy of one fraction of the wavelengths. As an actuator, a piezo is commonly used. The Ramp&Fire process, which has often been tested at Fraunhofer ILT, will be replaced by a cavity-dither process particularly due to the high mechanical stress and the typical process synchronization problem in the low vibration loads expected.

Method

The corresponding electronics were developed in collaboration with Beratron GmbH in order to implement this control task. To evaluate the resonance quality, the light of the seed source transmitted by the oscillator is detected with a photodiode. During dither phase, the piezo is controlled by the electronics such that it modulates the length of the resonator at 1 kHz.

1 Cavity-control card.

The regulator adjusts the center position of the piezo so that a symmetrical photodiode signal is detected. For the phase of the pulse generation, the piezo is statically driven in the optimum position.

Result

Single-frequency laser pulses could be reliably generated with the oscillator of the MERLIN laboratory demonstrator model in this process. The mechanical stroke of the piezo and, thus, the mechanical stress could be significantly reduced compared to the Ramp&Fire process. A final test under realistic vibration loads is still pending.

Applications

The control electronics is now available as a hardware solution in addition to the Ramp&Fire process and can be used as needed for the development of laser beam sources. Both control electronics are electrically and optically compatible and can be controlled via a controller system that has already been used in several lasers.

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