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ФАКУЛТЕТЕН СЕМИНАР

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A new concept for high accuracy and high speed laser ranging based on a frequency shifted feedback laser

Central to this presentation will be the discussion of a novel concept for laser ranging, suitable for industrial applications. It is based on a so called cavity-internal frequency shifted feedback laser (fsf-laser). In such a laser, the typical frequency-space mode structure is overcome by shifting the frequency of the circulating laser field at each round trip via an acousto-optical frequency shifter and feeding back only the frequency-shifted part. Injection seeding of such a device with a narrow band laser leads to a comb-structure in the continuous wave output spectrum (different from the well known comb structure in the spectrum of mode-locked femto-second lasers). Part of this radiation field is sent to a reference surface the other to the object. Superposition of the two coherent multi-component reflected or scattered fields on a fast photo diode leads to a complex response. The latter is simplified when the injected laser is phase modulated. The detector response is monitored as the modulation frequency is tuned. At a specific modulation frequency all the components contributing to the signal are in phase and a signal, orders of magnitude above the noise floor, results. The distance of the object is easily and accurately derived from the modulation frequency, leading to this maximum. Depending in the layout of the fsf-laser system, an accuracy of about 1 micrometer over distances of a few meters (with > 1kHz rate of data taking) or 0.1 mm over distances of several ten meters (with about 1 MHz rate of data taking) can be achieved.