Five wavelength DFB fiber laser source

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Figure 2. Instantaneous linewidth: (a) filled and open circles are experimental values at 3 mW and 100 mW output power, respectively. The dotted lines are theoretical fits, assuming the dependence of \((f_{\text{res}} - f_{\text{proper}})^{1/3}\) with \(f_{\text{proper}} = 288\) Hz.

In summary, we have reported a wavelength-swept fiber laser with up to 38-nm sweep range, <0.1 nm instantaneous linewidth, user definable spectral shape, and >100 mW output power. We believe such sources to have great potential for use in applications requiring accurate spectral control or measurements.

TuH3 Fig. 3. Peak-hold spectrum of the laser output: (a) AO frequency swept from 68 MHz to 69 MHz at fixed RF power giving flat spectral output over 20 nm; (b) triangular and square modulated output obtained by synchronous modulation of the filter transmission and peak wavelength.

TuH4 Five wavelength DFB fiber laser source

Stable single-mode laser sources with narrow linewidth are key components in high-capacity wavelength-division multiplexed (WDM) optical communication systems. Distributed feedback (DFB) and distributed Bragg reflection (DBR) fiber lasers are compact devices, which are able to provide stable single-mode operation. They are inherently fiber compatible and cascadable. We present a multiwavelength laser source consisting of five fiber DFB lasers spliced together and pumped by a single 60-mW 1480-nm semiconductor laser.

Each laser is fabricated individually using 5-cm erbium-doped fiber spliced to dispersion-shifted fiber and equipped with standard pigtails using angled connectors. The erbium-doped fiber has a dopant concentration of \(1.5 \times 10^{25}\) m\(^{-3}\), core diameter of 4 \(\mu m\), and a numerical aperture of 0.27 (supplied by Lycom A/S). The Bragg gratings are photoinduced using a KrF excimer laser illuminating a 5 cm long phase mask (fabricated by QPS) with 248-nm light. The fluence on the fiber is around 0.4 J/cm\(^2\) per pulse. After around 3000 pulses the 4.2 cm long gratings
TuH4  Fig. 1. Experimental setup for the five-wavelength DFB fiber laser source (crosses indicate fusion splices).

TuH4  Fig. 2. Optical spectrum of the multiwavelength DFB fiber laser, measured with 0.05-nm resolution.

The lasers show high temperature stability. Longitudinal and polarization single-mode operation without mode hopping has been verified continuously from room temperature up to 200°C as well as at −196°C. All lasers are written with a single phase mask. The wavelength is determined by the applied stress on the fiber during the writing process thereby changing the grating period when releasing the fiber. A wavelength change of about 5 nm can be achieved without breaking the fiber. The wavelength reproducibility of our current setup is around 0.2 nm.

After UV-writing the lasers, the angled pigtails are cut off and the lasers are spliced together and pumped with the same 60-mW semiconductor laser operating at 1480 nm (see Fig. 1), thereby forming a multiwavelength source. The peak wavelength separation is 1 nm ± 0.1 nm. Figure 2 shows the output from the five lasers. The difference in lasing wavelength.

TuH5 (Invited)  3:00pm

Analysis of fiber-grating-coupled semiconductor lasers for WDM applications

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A novel external-cavity geometry for a semiconductor laser can be constructed by coupling the laser light through an antireflection coating on the laser diode face into a fiber, some distance along which a Bragg grating is written in the fiber core. The grating forms one mirror defining the cavity, a high reflectivity coating on the back end of the diode serving as the other mirror. Design options include the choice of length of fiber providing the external cavity, as well as the choice of grating type—whether to both bandwidth and chirp—written in the fiber core.

In conclusion, we demonstrated a stable five-wavelength source suitable for WDM systems. The design principle is easily scalable to eight wavelengths. The position of the individual wavelength can be placed more precisely by using a customized phase mask for each desired wavelength.

TuH6  3:30pm

Broader and flatter supercontinuum spectra in dispersion-tailored fibers

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We show that using dispersion-shifted dispersion-decreasing (DD) fiber can enhance the supercontinuum (SC) generation process in comparison to constant dispersion or dispersion-increasing (DI) fiber. For example, we show that at 24.3 W peak input power, flatter spectra and twice the spectral broadening are obtained with DD fiber. SC sources are important for applications in multichannel systems and testing, as exemplified by the recent use of SC sources in 400-Gb/s telecommunications applications.1–5 The use of DD fiber is advantageous because