

CLAIMS

1. A laser device with a frequency discriminator for a distributed fiber sensing system, comprising:
 - a laser element for generating light; and
 - 5 a planar lightwave circuit (PLC) optically coupled to the laser element so as to receive light from the laser element, the PLC including a frequency discriminator component.
2. The laser device of claim 1, wherein the frequency discriminator component comprises a Mach-Zehnder interferometer with asymmetric arm lengths and a phase shifter in at least one arm.
- 10 3. The laser device of claim 1, wherein the laser element is part of an external cavity laser, and the PLC includes a wavelength selective component optically coupled to the laser element, so as to provide wavelength selective feedback to the laser element.
4. The laser device of claim 3, wherein the laser element comprises a reflective semiconductor optical amplifier (RSOA).
- 15 5. The laser device of claim 4, wherein the wavelength selective component comprises a Bragg grating.
6. The laser device of claim 5, wherein the frequency discriminator component comprises a Mach-Zehnder interferometer with asymmetric arm lengths and a phase shifter in at least one arm.
- 20 7. The laser device of claim 5, wherein the Mach-Zehnder interferometer is optically coupled to a portion of a waveguide including the Bragg grating, with the Bragg grating being optically between the RSOA and the Mach-Zehnder interferometer.

8. The laser device of claim 3, wherein the wavelength selective component comprises a waveguide with perturbations along at least part of a length of the waveguide.
9. The laser device of claim 8, wherein the perturbations along at least part of the length of the waveguide alternate from one side of the waveguide to another side of the waveguide along
5 the at least part of the length of the waveguide.
10. The laser device of claim 3, wherein the wavelength selective component comprises a waveguide with islands of waveguide material on at least one side of the waveguide along at least part of a length of the waveguide.
11. The laser device of claim 10, wherein the islands of waveguide material alternate from
10 one side to another side of the waveguide along the at least part of the length of the waveguide.
12. The laser device of claim 3, wherein the wavelength selective component comprises a ring resonator and a Bragg grating in series.
13. The laser device of claim 12, wherein the Bragg grating is coupled to a drop waveguide of the ring resonator.
- 15 14. The laser device of claim 13, wherein an output of the Bragg grating provides an optical output of the laser device.
15. The laser device of claim 12, further comprising a heater for the ring resonator to modify a transmission resonance of the ring resonator.
16. The laser device of claim 3, further comprising an integrated heater adjacent the laser
20 element, the integrated heater adjustable based on signals from the frequency discriminator.
17. The laser device of claim 16, further comprising an etched trench positioned on a side of the heater away from the laser element.

18. The laser device of claim 3, further comprising a phase modulator integrated with the laser element, the phase modulator adjustable based on signals from the frequency discriminator.
19. The laser device of claim 1, wherein an output signal of the frequency discriminator is coupled to a digital signal processor (DSP) of the distributed fiber sensing system.
- 5 20. The laser device of claim 19, wherein the output signal is for use by the DSP in correcting for wavelength fluctuations in light from the laser element.