

## **Characterization of phase noise in a single-mode fiber grating Fabry-Perot laser.**

### **ABSTRACT**

A comprehensive study on the phase noise characteristics of a single-mode fiber grating Fabry-Perot (FGFP) laser was conducted numerically. Adding to previous studies, the effects of external optical feedback (OFB), external cavity length, temperature, injection current, cavity volume, nonlinear gain compression factor and fiber grating parameters on phase noise characteristics are presented. The temperature dependence (TD) of phase noise was calculated according to the TD of laser parameters and not by the well-known Parkove equation. The frequency spectra of FGFP laser phase noise were calculated by using a Fourier transform. Results show that the TD of the phase noise in FGFP lasers is smaller than that for distributed feedback lasers. The shortest external cavity length that provides the minimum phase noise is found to be around 3.1 cm. In addition, the relaxation oscillation frequency shifts towards more than 6 GHz, which provides larger flat frequency range. Furthermore, phase noise can be eliminated either by increasing the injection current or the OFB level.

**Keyword:** Fiber Bragg grating; Numerical simulation; Phase noise; Rate equation; Semiconductor laser