Fast Wavelength Meter Precisely Maps Laser's Tuning Behavior

Introduction

The 828B High-Speed Optical Wavelength Meter revolutionizes WDM wavelength testing applications by providing accurate wavelength information at an unprecedented rate of 1 kHz. This results in more efficient wavelength testing of WDM components reducing test times from hours to minutes. In addition, the time resolution of 1 millisecond provides the most detailed wavelength characterization of tunable WDM lasers.

To demonstrate the capability of the 828B High-Speed Optical Wavelength Meter, it was used to measure the absolute wavelength of an external cavity diode laser as it was tuned. The results show how the laser's wavelength changes during the tuning process. The stability of the laser's wavelength when it is in a steady state is also shown.

Test Parameters

A tunable external cavity diode laser was programmed to step 10 pm every 10 seconds. The absolute wavelength of the laser was measured using an 828B High-Speed Optical Wavelength Meter. The accuracy of the wavelength measurement is ± 1 pm which is guaranteed by automatic calibration with a built-in wavelength standard. The measurement rate was set to 1 kHz, with data streaming to a PC over the 828B system's RS-422 serial interface.

Results

Figure 1 shows a graph of the wavelength of the external cavity diode laser measured over time. The 828B system's high measurement rate provides the most detailed view of how this laser's wavelength changes as it is tuned. The graph shows that the wavelength steps are closer to 8 pm, not the expected 10 pm. In addition, the graph shows that it takes some time for the laser's wavelength to settle to a steady state.

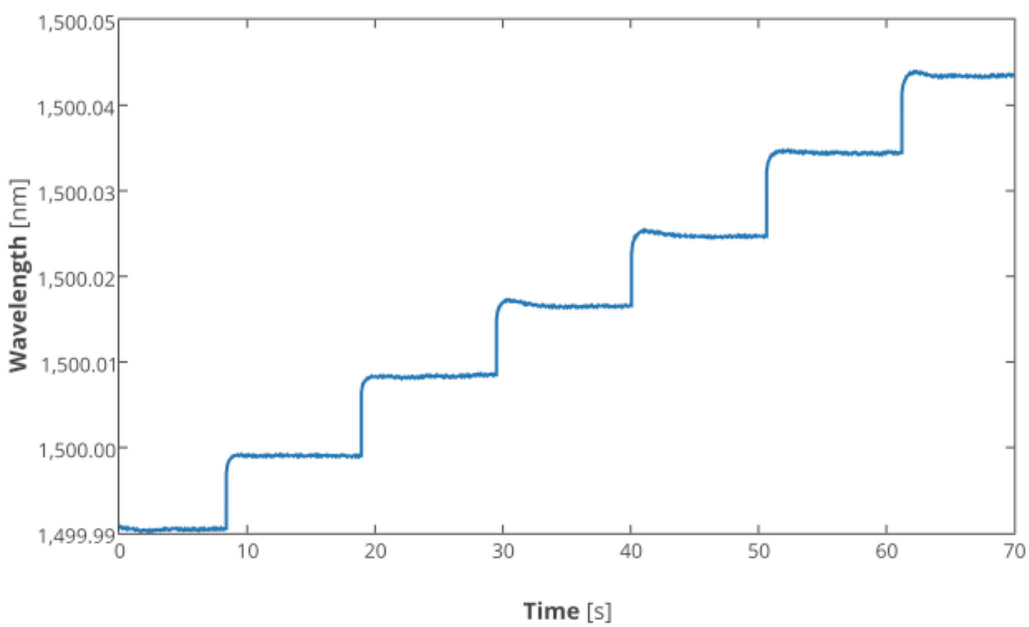

Figure 1. Laser wavelength vs time of tunable external cavity diode laser

The tuning process of the laser is demonstrated more clearly in Figure 2, an expanded portion of the wavelength vs time graph showing a single wavelength step. The laser's tuning process starts with an almost instantaneous jump in wavelength, but then slows as it reaches its target. The laser wavelength overshoots its target by about 1 pm, and then settles to a steady state after about 5 seconds.

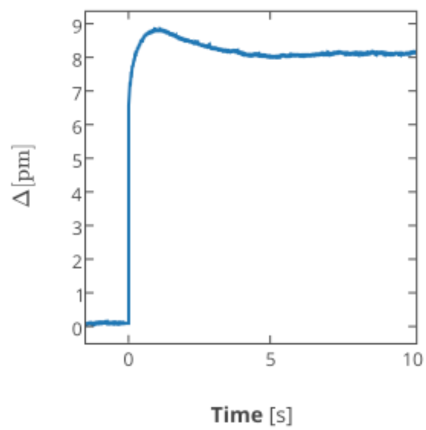

Figure 2. Laser wavelength vs time of a single tuning step

Figure 3 shows an expanded portion of the wavelength vs time graph when the laser wavelength is in a steady state. This graph shows that the laser wavelength actually oscillates with a peak-to-peak variation of about 0.1 pm and a period of about 25 ms.

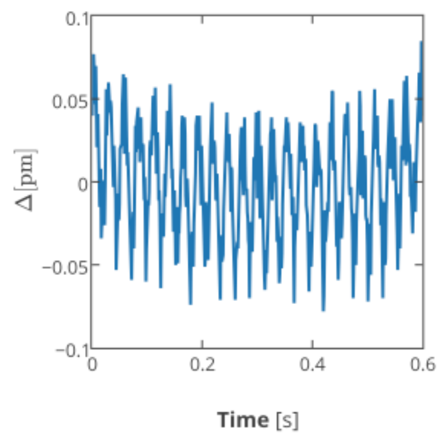

Figure 3. Laser wavelength vs time during steady-state operation

Conclusion

For the most demanding applications, it is critical to fully understand the behavior of a tunable laser. The 828B High-Speed Optical Wavelength Meter, with its unique capability of measuring absolute wavelength at a rate of 1 kHz, provides the most comprehensive detail of a laser's tuning characteristics.

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