Analisa dan rancang bangun pembangkit gelombang mikro berbasis teknik superposisi dua laser DFB dengan operasi pengaturan temperatur = Analysis and development of microwave generation based on two DFB laser superposition mixing technique by temperature control

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Abstrak

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Laser semikonduktor dapat diimplementasikan diberbagai bidang, diantaranya adalah bidang telekomunikasi, radar, spektroskopi dan sensor. Khusus pemanfaatan dalam bidang telekomunikasi, laser dimanfaatkan untuk membangkitkan gelombang mikro dengan teknik heterodyne dengan cara mixing dua sumber laser. Dalam aplikasi ini, kualitas stabilitas panjang gelombang laser menjadi sangat krusial untuk menghasilkan kestabilan sumber gelombang mikro yang diinginkan. Dalam beberapa penelitian telah dilaporkan bahwa perubahan temperatur menyebabkan perubahan panjang gelombang secara linear. Dalam pengujian yang kami lakukan, dibuktikan bahwa kenaikan temperatur menyebabkan pergeseran Bragg wavelength kearah long wavelength pada tipikal laser sebesar 0.094 nm/oC. Selain pergeseran panjang gelombang terhadap variasi temperatur, dibuktikan juga bahwa kenaikan temperatur menyebabkan penurunan daya optis pada output laser. Dari hasil penelitian yang kami lakukan didapatkan nilai tunabilitas gelombang mikro terhadap variasi temperatur laser sebesar 10.35 GHz/oC dan nilai tunabilitas gelombang mikro terhadap variasi arus injeksi laser sebesar 0.37 GHz/mA. Dalam penelitian ini kami menunjukkan bahwa beat frekuensi hasil mixing dua laser dioda dapat dituning dengan memvariasikan temperatur salah satu laser dan membiarkan laser lainnya konstan. Kestabilan gelombang mikro yang dihasilkan terhadap kestabilan temperatur laser didapatkan nilai ±2.7 GHz.
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ABSTRACT
Semiconductor laser can be implemented in various fields, such as for telecommunication, radar, spectroscopy and sensor. Specialized for telecommunication application, laser can be applied to generate microwave with heterodyne technique by mixing two laser sources. In this application, the quality of the laser wavelength stability is crucial in order to generate stability desired microwave source. In some studies it has been reported that the change of temperature causes the wavelength changes linearly. In our experiment, it is proven that the increase in temperature causes a shift in the peak wavelength toward the long wavelength laser typical of 0.094 nm/oC. In addition to the shift in wavelength, it is also shown that the increase in temperature causes a decrease in the optical power at the laser output. From the experiments of mixing two lasers that we have conducted, it was found that the tunability factor of laser beat frequency versus temperature is 10.35 GHz/oC and the tunability beat frequency caused by injection is 0.37 GHz/mA. In this paper we show that the beat frequency of the result of mixing two laser diodes can be tuned by varying the temperature of one laser and let the other laser constant. From the experiment, the microwave stability we can obtain ±2.7 GHz.
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