

激光技术

Pound-Drever-Hall稳频方法的Multisim建模分析

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摘要:

Pound-Drever-Hall(PDH)稳频方法涉及光学和电学2个部分,综合仿真较为困难.针对该问题,设计了PDH的电路部分.根据器件的工作原理,采用电路模型搭建光学元件.在此基础上进行了器件的单独仿真和开环PDH光、电综合仿真,仿真使用长度为15cm,腔镜反射率为0.97的Fabry-Pérot腔(F-P腔),并采用20MHz的调制频率.仿真结果表明:器件模型搭建合理;激光器在无频率漂移时,系统输出较小幅度的零漂移信号;在频率漂移为5MHz,10MHz,15MHz时,系统输出较为理想的误差信号.最后对仿真结果进行了讨论,并提出了改进方案.

关键词: 激光稳频 建模分析 光电仿真 Multisim

Modeling and analysis of Pound-Drever-Hall method using Multisim

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Abstract:

Pound-Drever-Hall(PDH) stabilization involves both optics and electric parts, and it is difficult to simulate PDH method synthetically. This article is aimed at solving this problem. Firstly, the electrical part of PDH was designed. Then, the model of electric circuit was used to form the optical device after analyzing the operation principle. Based on these, independent tests of devices and a synthetic simulation were successfully carried out. The Fabry-Pérot cavity (F-P cavity) used in simulation has a length of 15cm with a mirror reflectivity of 0.97. The simulation results prove that the model of the device is reasonable. The system outputs a small zero-drift signal while the frequency shift is zero. At the frequency shift of 5MHz, 10MHz and 15MHz, the system has satisfactory outputs respectively. Some discussion on synthetic simulation result and proposals for improvement are given.

Keywords: laser stabilization modeling simulation Multisim

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参考文献:

[1] POUND R V. Electronic frequency stabilization of microwave oscillators [J] . The Review of Scientific Instruments, 1946,17(11):490-505.

[2] DREVER R W P, HALL J L, KOWALSKI F V, et al. Laser phase and frequency stabilization using an optical resonator [J] . Applied Physics B,1983,31:97-105.

[3] ZIMMERMANN E, SALVADE Y, DANDLIKER R. Stabilized three-wavelength source calibrated by electronic means for high-accuracy absolute distance measurement [J] . Optics Letters, 1996,21(7):531-533.

[4] 孙旭涛,陈卫标.基于法珀标准具的激光稳频方法理论研究 [J] .光子学报,2007,36(12):2219-2222.

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- [5] CHAMBERS J P. High frequency pound-drever-hall optical ring resonator sensing [D]. Texas: Texas A & M University, 2007.
- [6] HUNTINGTON E H, JAMES M R, PETERSEN I R. Laser-cavity frequency locking using modern control [C]. Proceedings of the 46th IEEE Conference on Decision and Control. New Orleans: [s.n.], 2007.
- [7] BLACK E D. An introduction to pound-drever-hall laser frequency stabilization [J]. American Association of Physics Teachers, 2001, 69(1): 79-97.
- [8] New Focus Corporation. TLB-6900 vortex II series user's guide [M]. California: New Focus Corporation, 2008.
- [9] YARIV A. Optical electronic in modern communications [M]. 5th ed. 北京: 电子工业出版社, 2002.
- [10] LALLY E M. A narrow-linewidth laser at 1550nm using the pound-drever-hall stabilization technique [D]. Virginia: Center for Photonics Technology of Virginia Tech, 2006.
- [11] 叶建波. 基于Multisim 8的压控振荡电路仿真分析 [J]. 山西电子技术, 2005(4): 25-26.
- YE Jian-bo. Simulation and design of VCO circuits based on multisim 8 [J]. Shanxi Electronic Technology, 2005(4): 25-26. (in Chinese with an English abstract)

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