

论文

光纤型外部光反馈DFB激光器的非线性动力学特性的实验研究

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摘要:

实验研究了光纤型外腔反馈作用下DFB激光器的各种非线性动力学行为。通过分析DFB激光器的输出光谱、频谱以及时间序列,单周期、多周期以及混沌等多种典型的非线性动力学行为被直接观察到。在一定的反馈强度范围内,随着反馈强度的增大,非线性动力学行为的周期性逐渐减弱,而复杂性不断增强,最终进入频率连续覆盖范围很广的宽谱混沌动力学区域。实验还发现,在连续谱背景上存在多个特征频率峰,这些特征频率的位置不随反馈光的强弱而发生明显变化。

关键词: 非线性动力学 混沌 DFB激光器 光纤型外腔光反馈 Nonlinear dynamics Chaos DFB Semiconductor laser Fiber external cavity optical feedback

Experimental observations on the nonlinear behaviors of DFB semiconductor lasers under fiber external cavity optical feedback

Abstract:

In this paper, the nonlinear dynamic characteristics of the distributed feedback semiconductor lasers (DFB-SLs) subject to external feedback from a fiber cavity have been investigated experimentally. The experimental results show that DFB-SL under external feedback is very sensitive to feedback strength and can exhibit various nonlinear dynamical characteristics. After observing the optical spectrum, the radio frequency spectrum and the time trace of the output nonlinear dynamics, the rich nonlinear dynamic phenomena such as period-one oscillation multi-period oscillation and chaos have been identified by changing the feedback strength. Especially, when the laser exhibits the complex chaos dynamics, its power spectrum is very broad continuous spectrum with several peaks whose frequencies are independent on the strength of the feedback light.

Keywords:

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