摘　要

論文名稱：光固子壓縮飛秒反向光注入鎖模半導體光放大器光纖雷射
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關鍵詞：半導體光放大器、光反向注入、鎖模雷射、脈衝壓縮

在本論文中，我們主要研究與分析反向光注入鎖模半導體光放大器(SOA)光纖雷射系統，藉由光注入的方式調變半導體光放大器，使其光纖雷射產生鎖模。在理論模擬上與實驗上同時驗證與分析增益消耗形狀與調變頻率對反向注入鎖模所造成的影響，在光注入調變的情況下，逆脈衝光注入比正脈衝注入容易形成良好且無多餘平台的鎖模脈衝，並且在 10GHz 的重複率上得到 5.4 皮秒的脈衝寬度。正脈衝與逆脈衝波不同的是，脈衝注入無法造成有足夠的增益消耗時間，使得在未注入瞬間可以得到短時間的增益。在線性壓縮脈衝方面，是利用高負色散的光纖，使得存在於光脈衝的啾頻與其色散現象相互作用，進而達成光脈衝壓縮。而非線性壓縮脈衝，則是利用光固子的效應，自相位調變現象與光纖中之色散現象相互作用，並在最佳的一個長度上，擷取出在作用中最窄的壓縮脈衝。但由於在此脈衝壓縮的機制中，會產生一很大的底盤效應，使得產生之脈衝品質變低。有鍵於此，產生出來的光壓縮脈衝必須再處理，而處理方式，是利用光纖非線性現象中的雙折射效應，讓不同的光強度，產生不同的相位差，不同的偏振態，用以去除底盤，而達到一個無底盤效應的乾淨非線性壓縮脈衝。

ABSTRACT

Title：Femtosecond Soliton-Effect Compression of Backward-Optical-Injection Mode-Locked Semiconductor Optical Amplifier Fiber Lasers

Pages：1

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Keywords：Semiconductor Optical Amplifier, Optical Backward Injection, Mode-Locked Fiber Laser, Pulse Compression

In this thesis, we study the harmonic mode-locking dynamics of a backward optical injection modulated SOAFL. The effects of gain-depletion time and modulation frequency on the mode-locked pulse shape and power have also been theoretically analyzed and experimentally demonstrated. The backward sinusoidal-wave modulation is much easier to initiate harmonic mode-locking in SOAFL than the gain-switched modulation, which generates pulsewidth as short as 5.4 ps at 10 GHz. The difficulty in mode-locking the SOAFL by optical short pulse injection is also demonstrated and explained, which is attributed to the insufficient gain-depletion time (as well as modulation depth). In the linear pulse compression, the negative high dispersion fiber compensates negative chirped pulse. Furthermore, the nonlinear pulse compression uses a piece of optimum fiber length to compress linear pulse compression. It employs SPM and GVD interplay in a fiber. It also needs a high peak power to generate nonlinear effect. But the pulse has a large pedestal. Finally, we use the intensity discriminator to remove pedestal. It uses the intensity dependent birefringence effect in optical fibers and to realize pedestal free nonlinear compressed pulse. The pulse width is equal to nonlinear pulse compression pulse.