

IPT 523100 半導體雷射動態與應用
Dynamics of Semiconductor Lasers and Their Applications

Course Description:

本課程講述半導體雷射之動態特性及其應用。除將先介紹半導體雷射之動態及雷射渾沌行為之理論基礎外，亦將綜述半導體雷射受光回饋、光注入、光電回饋、以及電流調變時之動態特性。除此之外，本課程亦將討論半導體雷射動態於控制感測、保密通訊、超寬頻雷達及雷射雷達等特殊應用之概念。

本課程將結合講授、數值模擬實作、實驗展示等形式，目的為讓學生能深入了解半導體雷射動態之相關原理及基礎、學習雷射動態數值分析工具及方法、透過實驗展示實際體驗雷射動態行為、並討論本領域最新之研究進展。

本課程適合相關領域研究生或對半導體雷射動態及雷射渾沌有興趣之學生選修。

Course Syllabus:

Part I. Overview

1. Introduction

Part II. Theory

2. Chaos in Laser Systems
3. Semiconductor Lasers and Theory
4. Theory of Optical Feedback in Semiconductor Lasers

Part III. Dynamics of Semiconductor Lasers

5. Dynamics of Semiconductor Lasers with Optical Feedback
6. Dynamics in Semiconductor Lasers with Optical Injection
7. Dynamics of Semiconductor Lasers with Optoelectronic Feedback and Modulation
8. Instability and Chaos in Various Laser Structures

Part IV. Applications

9. Chaos Control and Applications
10. Stability and Bistability in Feedback Interferometers and Their Applications
11. Chaos Synchronization in Semiconductor Lasers
12. Chaotic Communications in Semiconductor Lasers
13. Chaos-Based Radar and Lidar
14. Microwave Photonics Utilizing Semiconductor Dynamics

Grades:	Simulation Reports	20 %
	Experiment Reports	20 %
	Project Report and Presentation	30 %
	Final Exam	30 %

Text Book: Semiconductor Lasers: Stability, Instability, and Chaos, Junji Ohtsubo (Springer, 2nd Edition)
Class Notes

References: Chaos in Dynamical Systems, Edward Ott (Cambridge)
Fundamentals of Semiconductor Lasers, Takahiro Numai (Springer)
Digital Communications Using Chaos and Nonlinear Dynamics, Lawrence E. Larson, Jia-Ming Liu, and Lev S. Tsimring (Springer)