EE5230 Analog Circuit Design 類比電路設計

Course Remarks

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Course Introduction

❑ This is an extended course of analysis and design analog integrated circuits. It covers quantitative performance analyses and design considerations from system, circuit, and physical viewpoints. All material is for CMOS technology.

❑ This course is based on the course of microelectronic. You should have basic knowledge on modern semiconductor operation and fundamental skill in circuit analysis.

❑ This course is offered by Chinese.

❑ The course loading including homework and term project will be heavy. You have to reserve more time for study and simulation.

Note :

今年課程將有較大改變! 在您修課前, 請先評估

1. **本課程非基礎課程**, 會將較多時間用於後段較困難的amp設計及模擬討論.

2. 本系大學部**EE3235 類比電路分析與設計一**是基礎課程, 建議優先考慮.

3. 本課程將大量使用HSPICE為作業模擬之用, 課堂上將無額外時間進行軟體教學.

4. 本學期可能有一次上機考試, 包含模擬及報告.

5. 本課程成績期末將不會調整. 各類需求, 包含博士班資格考, 及各學程必修等, 將不被接受成為調分的理由.

本課程將於下階段開放修課人限至98名, 9月12日至9月29日將進行下階段加退選,
加退選期間只要是人限之內, 本校同學可自行上網點選, 不需辦理加簽流程。

本校因疫情, 第一週即是線上課程. 第一週的相關課程資訊, 將放置於授課教師個人網頁
https://www.ee.nthu.edu.tw/pchuang/ 課程連結, 後續相關課程進行, 將於學校 eeclass 系統進行, 採非同步教學.

Score

❑ Homework (15% x 5)

  ➢ Individual work. Ok for discussion, but no copy is allowed.
  ➢ No Delay policy.

❑ Term Project (25% x 1)

  ➢ A multi-stage operational amplifier design.
  ➢ No layout. Only design and simulation.
  ➢ Individual work. Ok for discussion, but no copy is allowed.
  ➢ A complete report at week 18.

❑ On-Site Test (total score x scaling factor)

❑ No final score adjustment !

Course Information

❑ Tools : *HSPICE* will be extensively used for simulation.

❑ Textbook:

   ⊕ Behzad Razavi, ***Design of Analog CMOS Integrated Circuits,*** 2nd Edition, McGraw-Hill, 2017.

   ⊕ Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, and Robert G. Meyer, ***Analysis and Design of Analog Integrated Circuits,*** 5th Edition, John Wiley & Sons Inc., 2009.

❑ Reference book:

   ⊕ Behzad Razavi, ***Fundamental of Microelectronics,*** 2nd Edition, John Wiley & Sons Inc., 2014.

Course Content

- ✛ Introduction   (chap 1)
- ✛ CMOS device operations and models   (chap 2)
- ✛ Elementary gain stages   (chap 3, 4)
- ✛ Current sources and biasing   (chap 5)
- ✛ Frequency responses   (chap 6)
- ✛ Operational amplifier basic   (chap 9)
- ✛ Feedback, stability and compensation   (chap 8, 10)
- ✛ Operational amplifiers circuits   (chap 9)
- ✛ Differential-type op-amp designs   (G&M chap 12)

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Homework and Project (Tentative)

❑ Homework

  . Common Source with Performance Optimization

  . Differential Pair with Linearity Consideration

  . Transimpedance Amplifier with Feedback Analysis

  . Closed-loop Buffer with Single-Ended Operation Amplifier

  . Common Mode Feedback

❑ Term Project

  . Fully Differential Operation Amplifier and its Application

Course Timetable (Tentative)

Week				
Week 1	9.14	9.16	Introduction (3)	
Week 2	9.21	9.23	CMOS device and modeling (3)	
Week 3	9.28	9.30	Single-stage amplifier	HW1 – Common Source
Week 4	10.5	10.7	Single-stage amplifier (5)	
Week 5	10.12	10.14	Multi-stage amplifier (2)	
Week 6	10.19	10.21	Differential configuration (4)	HW2 – Differential Pair
Week 7	10.26	10.28	Current mirrors (2)	
Week 8	11.2	11.4	Feedback (5)	
Week 9	11.9	11.11	Stability & Compensation	HW3 – Transimpedance Amp
Week10	11.16	11.18	Stability & Compensation (5)	
Week11	11.23	11.25	Common Mode Feedback (3)	
Week12	11.30	12.2	Two-stage op-amp (3)	HW4 – Single-end Op-Amp
Week13	12.7	12.9	Differential op-amp	
Week14	12.14	12.16	Differential op-amp (6)	
Week15	12.21	12.23	Common Mode Feedback (3)	HW5 – Common Mode Feedback
Week16	12.28	12.30	Discussion	
Week17	1.4	1.6	Discussion	On-Site Test