Lecture 1.a
Class Introduction

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http://ipower3es.ucsd.edu/

ECE 125A – Introduction to Power Electronics I

UCSD Jacobs School of Engineering

Hanh-Phuc Le

Associate Professor, UC San Diego

- **Ph.D.** **UC Berkeley, USA** **2013**
- **M.S.** **KAIST, Korea** **2006**
- **B.S.** **HUST, Hanoi, Vietnam** **2003**

- **Prior experience:**
  - University of Colorado Boulder 2016 – 2019
  - Lion Semi., San Francisco, CA 2012 – 2015
  - Rambus, Sunnyvale, CA 2012
  - Intel, Beaverton, OR 2009
  - Oracle, Santa Clara, CA 2008
  - JDA Tech., Korea 2004 – 2007
  - VAST, Vietnam 2002 – 2004

LION SEMICONDUCTOR → CIRRUS LOGIC

Rambus

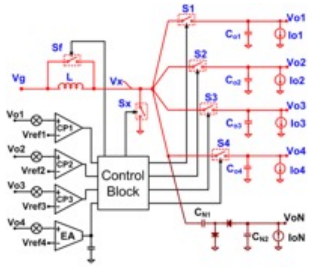
intel

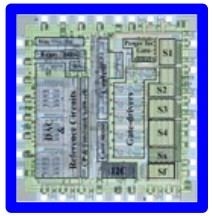
University of Colorado Boulder

ORACLE

The Quest for iPower Circuits

SIMO (‘07-‘09)

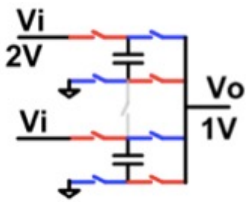


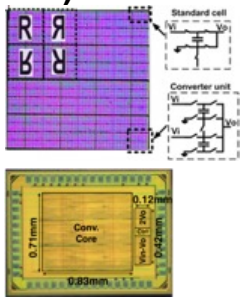


in LG SH150A (3G)

AMOLED

SC – FIVR (‘10-‘13)

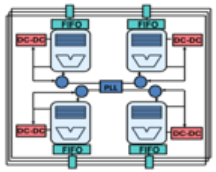


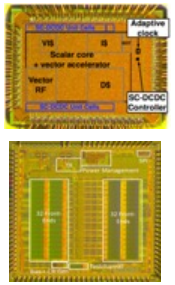


1st hi-perf. SC conv.

1W/mm², sub-ns response

Integ. Sys. and Func.(‘14-‘16)

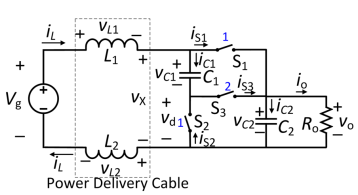




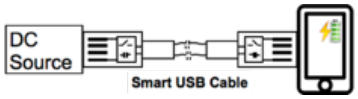
1st core with SC ripple conv.

iPower for brain implants

Hybrid Co . (‘13~)

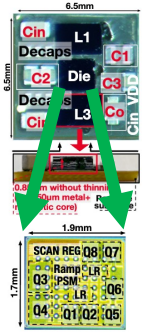


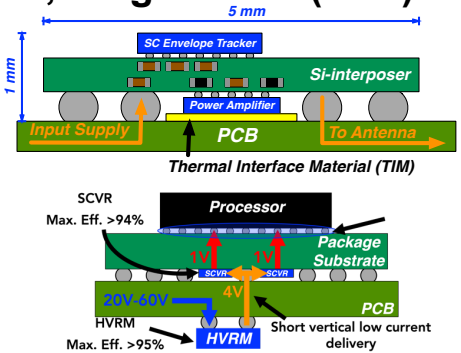
Integrate w/ Env. (‘17~)



material, smart architecture

High-V, Large Conv. (‘18~)





Class Logistics

- **All communications on Canvas**
  - Calendar
  - Media Gallery
    - Class videos
  - Files
    - Lecture slides
    - CAD Tools materials
    - Assignments
  - Assignments and Exams: Gradescope
    - Online submission, PDF
  - Discussions: Piazza
  - Grades: Gradescope and Canvas
  - Modules: follow all main activities
- **Lab: PLECS simulation**
  - Install on your personal computer.
    - Can support on campus server.
  - You will receive instructions to acquire license. Expect a questionnaire this week for this.
    - License will be given to you in one week.

Class Information

Time:	Lecture: Tuesday/Thursday 12:30 PM ~ 1:50 PM, DIB 122 (in-person only) Discussion Section: Monday 4:00 PM ~ 4:50 PM, WLH 2204 (in-person only)
Instructor:	Prof. Hanh-Phuc Le (hanhphuc@ucsd.edu) Office Hours: Monday 1:00 PM ~ 2:00 PM over Zoom (or by appointment)
TAs:	Nam Vu <h2vu@ucsd.edu> Xinyu Chen <x4chen@ucsd.edu> Snir Kinog <snkinog@ucsd.edu> Office Hours: at the lab WLH 2213B
Admin:	Bethany Carson (bacarson@eng.ucsd.edu) Jacobs Hall, Room 2904
Course Websites:	https://canvas.ucsd.edu/
Grading:	15% Homework + Quiz (lowest score will be dropped) 15% Labs 35% Midterm exam 35% Final exam
Textbook:	Power Electronics, By: D. W. Hart, McGraw-Hill, 2010, ISBN: 0073380679, 9780073380674
Reference Textbooks:	- Fundamentals of Power Electronics, Second Edition By: R. Erickson, D. Maksimovic, Kluwer Academic Publishers, 2001 - Principles of Power Electronics By: J. G. Kassakian, M.F. Schlecht & G.C. Verghese, Addison Wesley, 1991 - Power Electronics-Converters, Applications, and Design, 3rd Edition By: N. Mohan, T.M. Undeland and W.P. Robbins, 2003.
Prerequisites	ECE35, ECE65, ECE121, ECE188-Energy Conversion

Class Contents

Topic	Lecture/Meeting
Introduction to Power Electronics	1
Power semiconductor devices and characteristics	1
AC-to-DC rectifiers: Single-phase and three-phase, half-wave and full-wave, control	3
Non-Isolated DC-DC converters: Linear regulator, Buck, Boost, Buck-Boost	4
Midterm	**1**
Isolated DC-DC converters: Flyback, Forward, Push Pull, Full Bridge and Half bridge converters	4
Power loss calculation and thermal design	2
Related circuits: protection, filtering, snubber, etc.	1
Resonant converters	3
Final	

Required Work and Grading

- **Homework + Quiz (lowest score will be dropped): 15%**
- **Labs (PLECS simulations, experiment, and report): 20%**
  - Buck converter
  - Boost converter
  - Buck-Boost converter
- **Midterm exam: 30%**
- **Final exam: 35%**

Class Policy

- **Deadlines: beginning of lecture**
  - Strict deadline
  - but extension can be given with acceptable reasons
- **Homework discussion is allowed and encouraged**
  - But must submit individual unique solution.
- **Lab:**
  - Work and submission should be done individually.
  - Discussions and helping each others are encouraged.
  - No direct copy/sharing of actual circuit design is allowed
    - Possible collaboration is limited to sharing skill, knowledge, comparing numbers or similar.
- **All students are bound by the UCSD Academic Integrity**

Software

- **PLECS simulator by Plexim**
  - https://www.plexim.com/products/plecs
  - Intuitive and powerful tool for power system simulation
  - Lots of available online tutorials and documentations
  - Other possible tools: PSIM, SIMPLIS, LTspice, MATLAB, Cadence.
- **Will have the first lab on starting PLECS**
  - Use PLECS Standalone
    - Blockset: You can use it on your own.
  - To verify license and functional operation
  - Should be very simple