EE-612:

Nanoscale Transistors

Fall 2008

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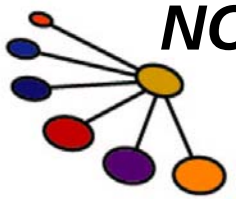

NCN

www.nanohub.org

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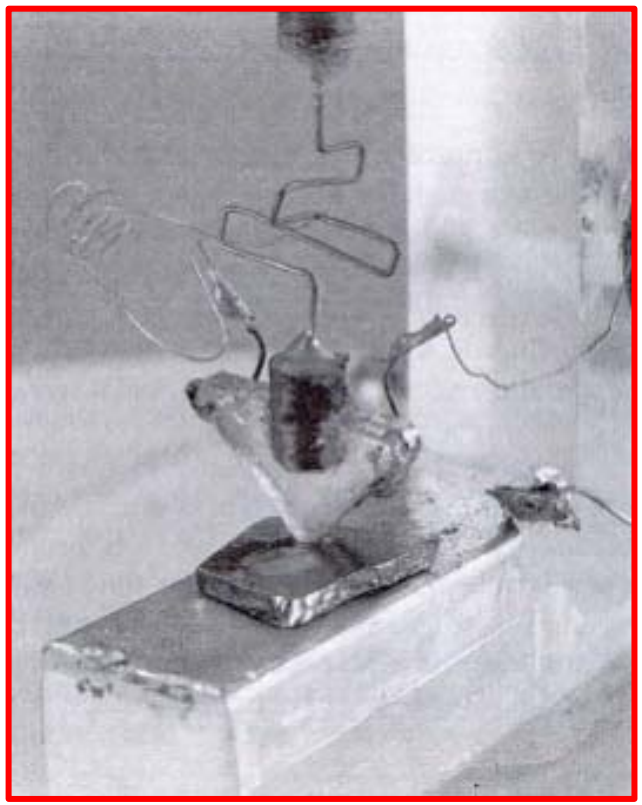
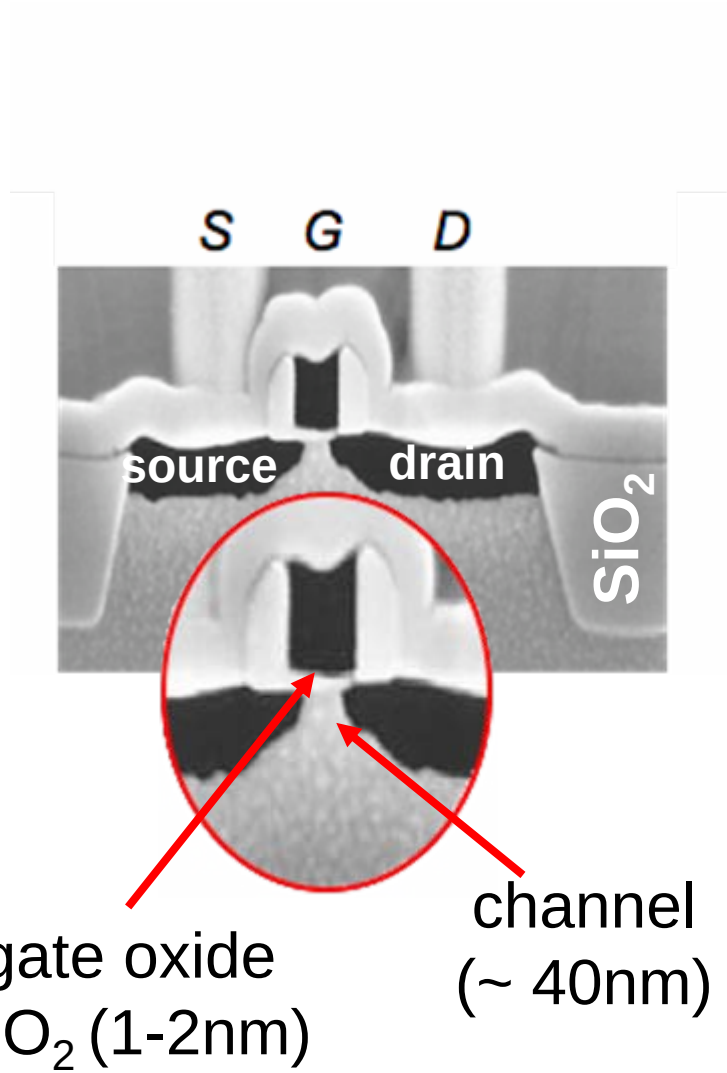
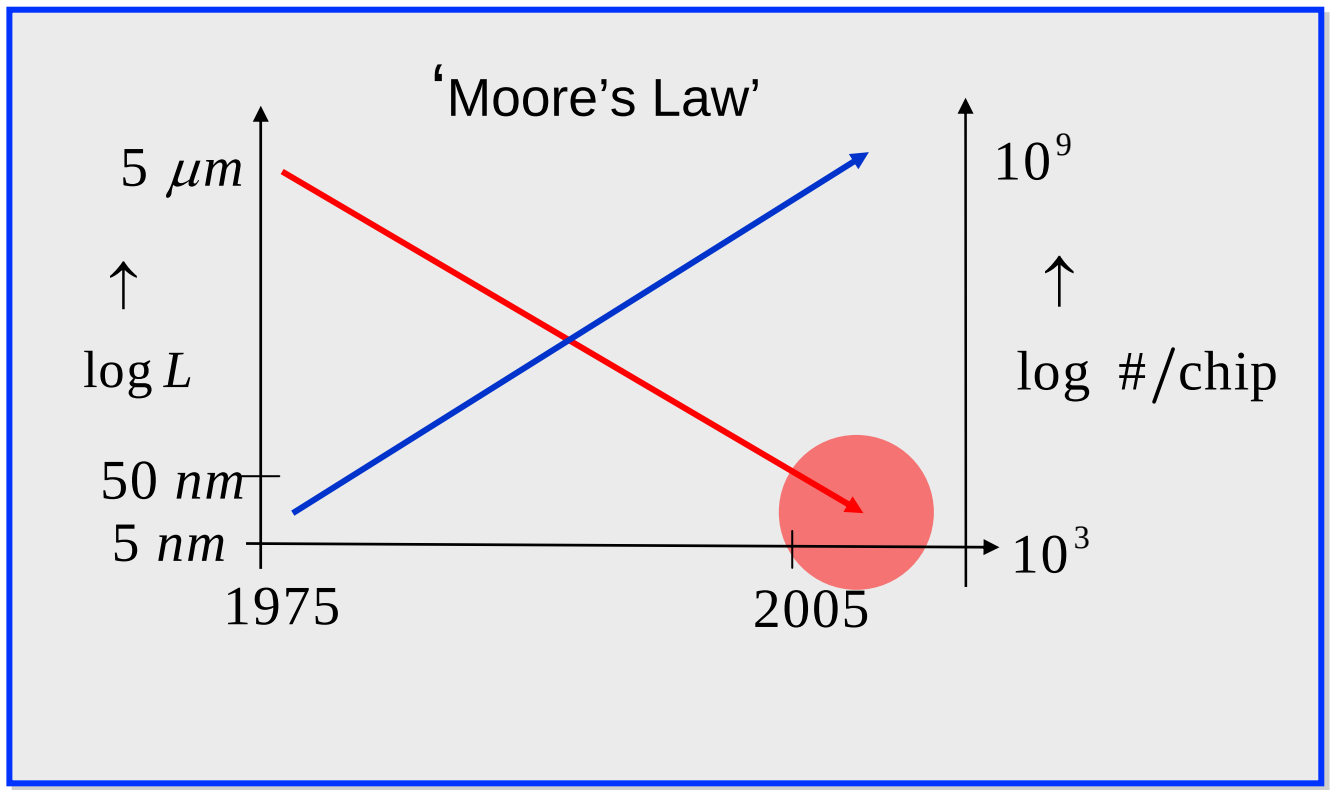
evolution of silicon technology

Bell Labs, 1947

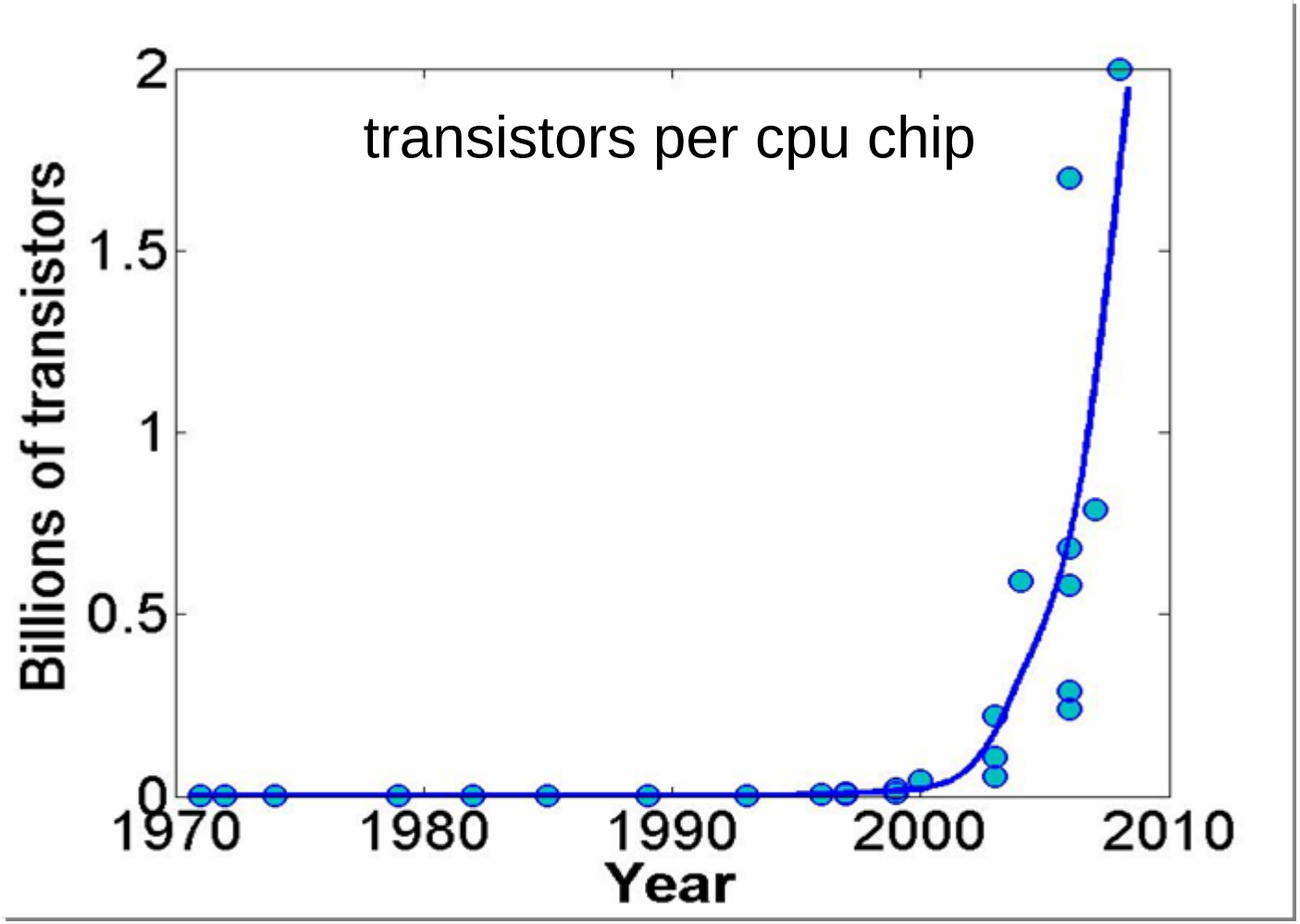




technology trends…..



20st Century electronics



course outcomes

After taking this course, students should:

- » ***Understand*** nanoscale MOSFET device physics.
- » Appreciate how device performance affects circuits and systems.
- » Be familiar with device scaling challenges.
- » Be introduced to new Si-based material and device approaches as well as other transistors.
- » Have the confidence to go “one-on-one” with device engineers and researchers.

course prerequisites

» Introductory level understanding of semiconductor physics and devices as well as basic electronic circuits. (EE255 and EE305/606 at Purdue)

(some basic MOS physics, devices, and CMOS circuits will be briefly reviewed)

course outline

Part 1: MOSFET fundamentals

6 weeks including 1 exam

Part 2: Short channel MOSFETs and technology

5.5 weeks including 1 exam

Part 3: Circuits, new materials and structures, and other transistors

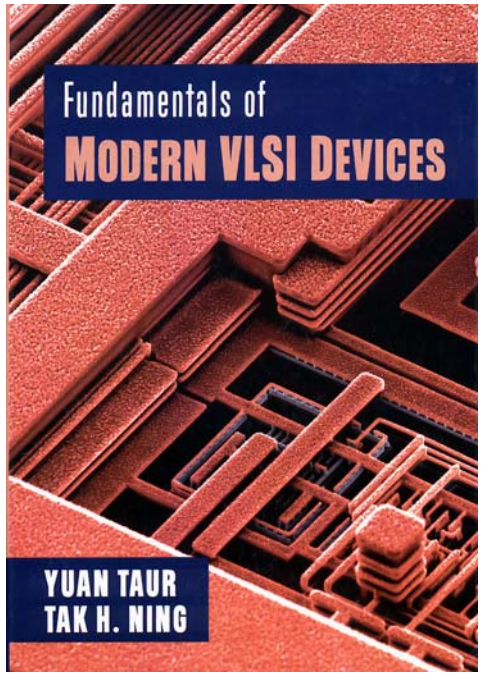
3.5 weeks

course text

Fundamentals of Modern VLSI Devices

Yuan Taur and Tak Ning

supplemented with class notes



Cambridge Univ. Press, 1998

www.cup.cam.ac.uk/

lecture format

- ~60 minute (PowerPoint) lectures followed by 15 min of questions and answers.
- Recorded and deployed online soon after.
- Possible evening sessions from time to time on special topics, make-up lectures, HW discussions, etc.

why simulations in EE-612

- As “laboratory” exercises (e.g. HW1)
- To solve equations that we can’t solve by hand (e.g. quantum effects on MOS-CV, 2D electrostatics, etc.)
- To illustrate concepts (Hamming’s “insight not numbers”)
- To learn how to be an intelligent user of simulation tools (no ‘Spice monkeys’ – learn to “stand up to the computer”)

course grading

Exam 1: 25%

-MOS and MOSFET fundamentals

Exam 2: 25%

-short channel MOSFETs, circuits and systems

Homework: 25%

Final: 25%

some suggestions

1) Do the reading ***before*** class (and after).

2) Supplement with online lectures.

3) Monitor *IEEE Trans. Electron Devices* and *Electron Device Letters* (and ask me questions).

4) Attend relevant departmental / Discovery Park seminars.

5) Monitor the course homepage for announcements, handouts, etc. (http://cobweb.ecn.purdue.edu/~EE612).

6) Do the homework.

HW 1

- Due Tuesday, Sept. 2, 2008. **At the beginning of class!**
- You will review MOSFETs, learn how to run simulations, and characterize a state-of-the-art MOSFET.
- And I'd like you to tell me about yourself and your goals for the course.
- HW will be lightly graded, and solutions will be posted. Your lowest HW score will be dropped when computing the final HW average. Students who need to miss class should plan accordingly. If you plan to be sick, please factor that in. One and only one HW score will be dropped.

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For additional information, refer to the course syllabus (also available on the class homepage)

Feel free to contact me at lundstro@purdue.edu

Good luck in EE-612!