NC STATE UNIVERSITY

Micro and Nano Systems

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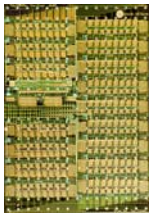
Outline

- Project Overview
- Trends Overview
- Personal group philosophy and my expectations

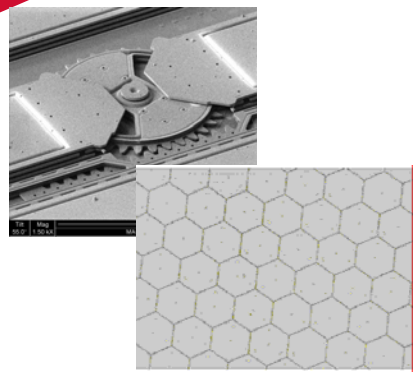
Paul D. Franzon

Micro and Nano Systems

CMOS VLSI
- Full Custom
- ASIC
- Low Power

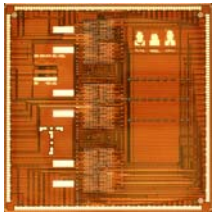


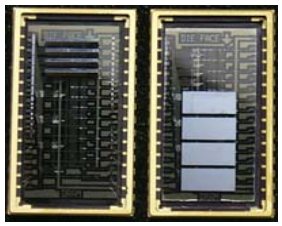
MEMS
- Bulk
- Surface
- Emboss
- Custom



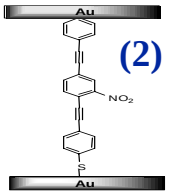
Novel Systems and Solutions
- Interconnect
- Computing
- Wireless
- DSP
- Networking
- CAD & Methodology

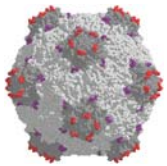
Advanced Packaging
- Seamless integration
- Embedded Passives





Nanotechnologies
- Viral
- Molecular





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Background Trends

- Globalization: Low-skill jobs moving to India, China & Russia
  - Coding, ASIC design. Anything that can be spec'd
  - Key to maintaining high value jobs in US : Innovation
    - Relative value of PhD increasing
- Market Growth : Moderate growth predicted
  - High Volume, low margin : Wireless, Computing, Networking
  - Low volume, high margin : Bio, sensors
- Moore's Law
  - Exponential growth continue to slow down
  - By 2020 semiconductor industry similar characteristics to auto industry
    - Unless new exponential growth technology ready
- Nanotechnology "boom"
  - Will happen, but don't know when (5-20 years)
  - Will be multiple point technologies, rather than one large one

Background Trends

- **National Research Infrastructure**
  - Becoming more focused
    - What is the benefit at the end of the project?
  - Becoming leaner
    - Reduced timescales, smaller budgets
  - Demanding more management per project
    - Shorter term scales; Higher expectations; More reporting
  - Becoming more competitive
    - Proposal success rate < 10%
- **What does this mean to us (really me)?**
  - Can't afford project "drift"
    - Can't afford drift for 6 months without significant progress
  - Have to "seed" future projects from current resources
    - To help win AND to create head start
  - Have to better position projects transition
    - Not research for its own sake

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Research Philosophy

- **Produce technologies that are ready for a decision on commercial transition at the end of the University project**
  - Identify and remove key barriers to deployment
  - Maintain proper key patent position
  - Interact with potential partners during project
  - License or spin-off? (or abandon/postpone)
- **Focus on technical work that leads to above goal**
  - Avoid research for its own sake
  - Can't do everything so determine what needs to be done well
  - Work closely with end customers

Research Philosophy

- **Keep the customer happy**
  - Customer = funding agency, PI, and potential commercialization partners
- **Maximize the value of the student experience**
  - You are investing in your future
    - Develop novelty & develop skills
  - Utilize our excellent infrastructure
    - Helps in both goals above!
    - Help maintain that infrastructure
  - Work as a group
    - Help each other
    - Don’t keep secrets

Student Research Philosophy

- **Maintain background knowledge**
  - Who, what, when, where?
  - Literature
  - Web, popular press
  - Get “big picture” of competitive landscape (not static)
  - Know details of important past contributions
- **Depth**
  - Novelty requirement
  - Focus to bring to transition point
  - Keep moving
    - Before days become months become years
    - Demonstration focus

Student Research Philosophy

- **Breadth**
  - Develop broad set of skills within your general topic
  - Use our unique infrastructure
  - Help each other
- **Transition**
  - Publish as early as suitable
    - Journal & conference
  - Identify and protect IP
  - Think about end transition users and help that guide your research agenda

Major Ph.D. Milestones

- **Ph.D. Qualifying Review**
  - Admits you to Ph.D. program
  - Standard: A conference level paper and presentation
- **Ph.D. Written In-Depth Exam**
  - Standard: Complete Literature Review
- **Ph.D. Preliminary Exam**
  - Admits you to candidacy for Ph.D.
  - Standard: Review of work so-far plus a constructive plan for remainder of Ph.D.
- **Ph.D. Final Defense**

Concluding Remarks

- **Core Research Philosophy:**

  Innovate; Demonstrate; Transition

- **Maintain people centric viewpoint**
  - Skills
  - Work together
  - Invest in people