Chapter 4

4.1 Choose Research Topics

- Demand from social and economic development.
- Curiosity and personal interests.
- Combining social requirements with personal interests.
- **Deep impact on one's career.**

Importance of interdisciplinary Research

- Tendency of modern science and technology and possible drive of discipline change and development.
- 40% of the work winning the Nobel Prize is in the areas no one claim to be in.
- The concepts and knowledge in one area may change the course of another area.
- New areas may come out as the inter-disciplinary research.

Form of interdisciplinary research

- Researches from different fields collaborate to work on some particular problems.
- Researches mutually work on the problem of other fields.
  - One from field A work on the problem of field B
  - One from field B works on the problem of field A
- Researchers from different fields propose a new field
  - Bio informatics, system biology.
  - Network science and data science
  - Energy informatics (cyber-physical-energy-system)

Historical perspective on systems and control areas- an example

- The fundamental role of probability and stochastic process in system work.
  - Knowledge from outside the field influenced our research.
- The concept of what constitutes a solution to a problem routinely solvable
  - Practices in science and mathematics are changed by computer technology.
- The notion of dynamics and feed back in all their ramifications.
- Specific concepts the system field contributed to other fields.

Approach to choosing a research topic

- Comprehensive understanding of the state of art in well established areas.
- Demand oriented versus methodology oriented approach.
- Spend time in understanding the background and issues of unfamiliar areas.
- Prepare to work in a new area without many references.
- Prepare to work on difficult problems.

Observations on the new frontiers of science and technology in the 21 century

- **INFORMATION SCIENCE AND TECHNOLOGY , ESPECIAL INTERNET TECHNOLOGY**
- **LIFE SCIENCE AND BIOLOGICAL TECHNOLOGY**
- **ENERGY , ESPECIALLY NEW ENERGY**
- **ENVIRONMENT**

4.2 APPYING RESEARCH FUNDING AND WRITE PROPOSALS

- Applying funding in one of the lifelong tasks of a researcher.
- One of the most important standards or criteria for performance evaluation.
- Writing a good proposal is a necessity to get research funding.

Assumptions when writing proposals

- The reviewers are statistically unbiased and intelligent.
- The reviewers are smart but very busy.

- There are many smart researchers out there competing on the same subject and proposing similar or better ideas.

Strategies when writing proposals

- Concentrate on our side
- Present the key ideas clearly and convincingly in first two pages.
- Be creative and try very hard to set up new problems and propose new approaches unlikely to be thought about by others.

Emphases on different categories of Chinese proposals

- Basic and applied basic research - NSFC, 973 , etc.
  - Originality of ideas and academic impact.
- Technology development - 863, S&T Support, etc
  - Technological innovation , applicability and commercial impact.
- One or both of the above plus HR, equipment , environment plus the above - 985, 211, etc.

CONTENTS OF A PROPOSAL

- Project descriptions
- References cited
- Biographical sketches.
- Budget
- Current and pending support
- Facilities , equipment, and other resources.

Project descriptions

- Introduction
  - Motivations
  - Basis for proposing the project
  - Current status(literature reviews)

Research contents

- Goals
- Proposed tasks
- The key issues to be resolved

Technical approaches

- Solution methodologies
- Experiment designs
- Key techniques.

Innovations or salient features

- Expected deliverables and milestones
- Current achievements related to the proposed project
  - Related projects completed
  - Related publications
  - Related duties

Biographical Sketches

- Key investigators in the team
- Educational background
- Academic duties
- Experiences
- Related publications

Budget

- Reasonable amount

- Follow the rules

Related Support

- Good summary of the past support and the achievements.
- Current support-report as needed
- Pending Support- report as needed

Defense for a key project

- Give PPT presentation on the project proposal usually 15-20 minutes.
- Apply all the principles and skills discussed in Lecture 2.
- THE GOAL - Convince the previewing panel!

Progress Report

- Background information: a good summary of project descriptions.
- A description of current status: results , methodologies, etc
- Conclusions
- Achievements so far: paper published and accepted, awards , patents.
- A good progress report may lead to a scientific paper.

Mid term field review

- PPT presentation on the progress.
- Demos on the achievements so far.

Final report and panel review

- Report on the overall progress and achievements
- PPT presentation on the overall achievements
- Demos on the achievements and applications
- Facilities, environment, etc.
- A good review ranking on the project helps the next project