Science in the 20th century

Materials and devices

- Relativity
- Quantum mechanics
- Chemical bond
- Molecular basis of life

Systems

- Robustness (Bode, Zames,…)
- Computational complexity (Turing, Godel, …)
- Information (Shannon, Kolmogorov)
- Chaos and dynamical systems (Poincare, Lorenz,…)
- Optimal control (Pontryagin, Bellman,…)

Current dominant challenges

Materials and devices

- Unified field theory
- Dynamics of chemical reactions
- Dynamics of biological macromolecules

Systems

- Robustness of complex interconnected dynamical systems and networks
- "Unified theory" of control, communications, computing

Current dominant challenges

- Robustness of complex interconnected dynamical systems and networks

Role of control theory

- Robustness
- Interconnection
- Rigor
- Talent

We need an expanded view of all of these.

Predictions and irresponsible speculation

Application successes and “revolutions”

- Turbulence
- Quantum measurement, systems, networks
- Statistical physics (irreversibility, power laws, …)
- Biological networks (gene regulation, signal transduction, …)
- Networking (congestion control, routing, QoS, wireless, …)
- Volatility in financial markets
- Simulation-based design of complex systems
- Ecosystems and global change
- Many others…..
- Theory from control can play the central role in all.

Predictions and irresponsible speculation

- Prospects for a unified theory of computation, communication, and control?
  - control
  - dynamical systems
  - theoretical computer science
  - information theory
  - statistical physics
- Uncertainty, robustness, and interconnection
- Control must lead