

# What's Good about Control and what will keep it that way

Workshop on  
The Future of Control And Dynamical Systems

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# The Outline

- The value of the systems point of view
- The rigorous training
- The confidence it gives people
- The need for better integration with CS
- Moving towards the theory of everything

# Conceptualizations

1. In terms of transfer functions
  2. In terms of matrices
  3. In terms of random variables
  4. In terms of iterative solutions
- Each involves useful abstractions and build confidence in the value of abstract thinking
  - Each excludes important classes of ideas and problems
  - Over the years we have expanded the list so that we can work with more problems
    - Game theory, Automata, Petri nets, NP hardness, ...

# Where is the Action?

1. Communications-because VLSI made it cheaper to use electromagnetic propagation for transmission of information.
2. Molecular Biology-because advances in biochemistry are often convertible to improvements in medicine and agriculture
3. Web related algorithms-because goods, services, and ideas are now being distributed in digital form
4. Materials Science-because the resources generated by the electronics industry supported new developments revealing new possibilities

# Do we need to define the future entirely in terms of applications?

- Problem solving is a two-way street. New problems often inspire the development of new tools.
- It now seems that the time is right for the development of a theory of language driven systems, based in part on the CS idea of a formal language
- New problems (instrumentation for biochemistry, single electron computing, quantum computing) call for new theoretical developments in nonlinear control in some cases involving more Lie algebras than ever imagined by Lie himself

## Next Steps

- **Where is the need for control?**  
This is what we need to spell out in the report
- **Where has control been the most successful in the past?**  
We need to provide vignettes to support any conclusions here.
- **Can the federal agencies take its further development for granted and invest their money elsewhere?**  
We need to answer this question in a way that policy makers will find compelling.