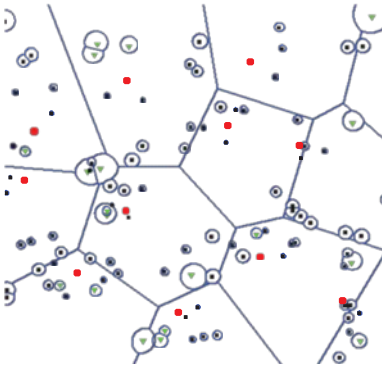

Our research group is interested in the theoretical issues surrounding dynamic programming and dynamic games. We are applying lessons learned and knowledge gained to the area of economic regulation of network industries such as electricity, communications and cybersecurity. Lastly, we are exploring the analysis of decentralized/distributed algorithms for optimization of large-scale systems.

# Optimization & Control Research Group


## Alfredo Garcia

Associate Professor
ag7s@virginia.edu
http://web.sys.virginia.edu/alfredo-garcia.html

Dept. of Systems & Information Engineering
University of Virginia
Charlottesville, VA
434.982.2191


"Integration optimization and stochastic modeling techniques in real-world applications."

UNIVERSITY of VIRGINIA
ENGINEERING

## Distributed Optimization and Control

Many centralized approaches for solving important resource allocation problems do not scale well. Pervasive wireless networking and distributed computing capabilities provide the basis for implementing a distributed approach. However, this requires a degree of coordination across many autonomous or semi-autonomous parts of a system. An additional layer of complexity in distributed system's design arises when autonomy is coupled with local objectives that may be in conflict with desired system-wide performance. Here, game theory provides a natural modeling choice for analyzing the compatibility of local incentives with system-wide objectives. To summarize, our research can be described as a systematic attempt to understand the implications of distributed decision or control authority and incentives in designing solutions for resource allocation in engineering problems.

## Economics of Engineering Systems: Energy

Increasing electric power production from renewable energy sources is currently one of the major objectives of energy policy. The intermittent nature of renewables, such as wind and solar, necessarily imposes complex trade-offs for regulatory objectives, such as resource adequacy (and system reliability) versus reductions in greenhouse emissions. We have analyzed dynamic investment models in electricity markets in order to derive insights regarding the workings of regulatory incentives for increased renewable energy.

## Economics of Engineering Systems: Communications

We have developed interference pricing schemes that would facilitate efficient re-allocation of spectrum for wireless networking. The basic setting in this context is as follows: primary users (i.e. those having a license or a "property right" over certain parts of the spectrum) allow secondary users to make use of the same spectrum bands provided certain bounds on aggregate interference are satisfied. The challenge is therefore to achieve a coordinated outcome (satisfying bounds on aggregate interference) by autonomous secondary users.

## RECENT RESEARCH DEVELOPMENTS

- New dynamic auction designs for the efficient allocation of congestible resources.
- New model-based algorithms for global optimization with multiple interacting threads.

## RECENT GRANTS

- National Science Foundation - Dynamic Pricing of Interference in Cognitive Radio Networks
- Air Force Office of Scientific Research - Flocking in Distributed Control and Optimization

**SEAS Research Information**
Pamela M. Norris, Associate Dean
University of Virginia
Box 400242
Charlottesville, VA 22903
pamela@virginia.edu
434.243.7683

UNIVERSITY of VIRGINIA
ENGINEERING