

The CUNY Institute for Computer Simulation, Stochastic Modeling and Optimization



Presentation

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A World Wide Trend

Academics at Universities around the world agree that there is need for better students training in science and mathematics. This is also what practitioners in Industry and the public sector are saying.

Improve students' mathematical and scientific skills.

Although few, there are students with outstanding capabilities, who are well trained in complex scientific and analytic methods. However, when they graduate rarely do these students understand how to apply their skills and complex knowledge to problem solving in a real context.

Improve students' understanding of realistic problems.

Scholarship is driven in part by the aim to study abstract concepts and generate new knowledge and methodologies. New scientific discoveries must wait decades before the public uses them widely.

Create communication channels between decision makers in the public and private sectors and academic researchers.

New technologies are evolving at accelerated rate, and society cannot afford to wait decades before new knowledge is well understood at large. The incorporation of computing power and sensor technologies into every aspect of our society is unprecedented. The new generation of practitioners needs to be better trained to be able to understand the consequences of such technological changes and how they will impact our future.

Establish an appropriate networking niche.

Our area of expertise

- **Mathematical Models:** relations of inputs and outputs and dynamics of complex systems. When subject to uncertainty and random events, we call it "stochastic modeling".
- **Computer Simulation:** virtual experimentation of policies and strategies without the costs or time associated with real implementation.
- **Optimization:** implementation of tools and methodologies for optimal design, decision-making, active management and "machine learning".
- **Statistics:** analysis of output and scenarios, as well as computer learning cutting-edge methodologies for use when dealing with large or non-numerical data.

The Vision for the Lab

Real problems arise in their specific context, for example: public transportation, telecommunications, finance, project management, energy production, etc. Although the same scientific tools and methodologies can be used to for control, design and management, the successful application of the methods in real life requires thorough knowledge of both the science and the practice. It is necessary to understand how to apply cutting-edge methodologies beyond the traditional to approach these problems in a modern context. Understandably, industry and the public sector may be unaware or unwilling to test new ideas that have yet to be well understood.

The student projects at CoSSMO will be formulated as concrete problems with a story. Examples are: simulation of RNA-RNA interactions for drug development; financial investment options; optimal policies for a public bike system; objective risk evaluation; food production under sustainable farming; intelligent batteries for a windmill farm, and so on. Students with different background specific knowledge (in biology, engineering, business administration, geography, agriculture, etc), will all be using common methodologies. Examples of these methodologies are: discrete event simulation; stochastic optimization; statistical analysis, and dynamical systems, among others.

Just put them all together!

In such a vibrant environment, shared experiences from diverse focused projects will promote learning across disciplines. The interactions between students and their advisors, with the underlying interdisciplinary nature of the Institute, will result in spontaneous collaborations, opportunities for Professors to work together across disciplines, and funding opportunities.

Academic and Intellectual Purpose of CoSSMO

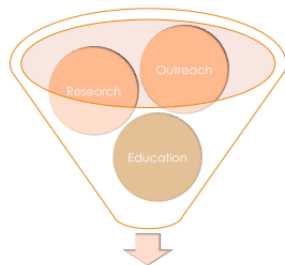
- To provide graduate and undergraduate students an experience that will enhance important skills for the workforce. To provide students with theoretical and fundamental insights supporting the application of computer simulation and optimization to solve real problems within a collegial environment.
- To increase productive research collaborations between CUNY faculty and colleagues, nationally and internationally.
- To create pedagogical material and case studies available to all CUNY faculty and students suitable for undergraduates.
- To increase and promote higher research output and knowledge transfer by identifying common features of current projects and potential new projects.

Integrated Approach: The ORE Principle

Outreach: Beyond the usual collaborative projects with industry, we envision projects that help develop mathematical and computer skills needed in the workplace. Each project will be validated through the endorsement from industrial partners and/or the Advisory Board.

Research: The Institute aims to establish a synergy of research and grant activity between the various colleges at CUNY and outside, focusing on all areas of the application of stochastic modeling, simulation and optimization. It will be very important to implement the Institute's operations so that different Departments and Faculty members benefit from cooperation, and that they should not compete for resources within the Institute.

Education: The research projects will foster interactions among students, faculty and industry members. Projects will be used to create pedagogical material as "case studies", made available throughout CUNY. Material gathered in this manner may be incorporated for training courses. Student internships at partner companies or government sectors and workshops at the Institute for the partner companies and government agencies will be promoted as well.



Building bridges

- Work with companies to apply mathematical models and simulation to solve problems.
- Provide students with "real" problems that need solution in the public and private sectors.
- Help students with critical thinking.
- Foster multidisciplinary research.
- Create new research opportunities.

The Mission of CoSSMO

In 2010, President Raab organized a meeting with a number of Faculty members of Hunter College campus to discuss the ideas of this integrated approach. Since then, we have also contacted members of other colleges across CUNY. Through consultation with the Faculty, we have identified the following desired outcomes:

- Help to re-write research grants, for good projects that have not yet resulted in funding.
- Help to identify potential applications of your research across disciplines.
- Help to establish contracts with industry and public sector.
- Access to teaching material ready with case studies (solutions, exercises).
- Wish to share your teaching material across disciplines.
- Find good students and define challenging team projects.

To address these issues, the mission of the CUNY Institute CoSSMO is as follows.

- To identify potential projects and participants across CUNY and in the community at large;
- to help members identify sources of funding and to prepare grant applications;
- to facilitate the execution of the projects, providing advice, space, and computer facilities;
- to create research programs by aggregating multiple projects with common defining factors. Such programs will promote interactions and networking that will increase the value of the research activities with respect to the contribution of individual projects;
- to manage program projects with core competencies; and
- to establish collaborations outside CUNY (national and international).

Why support the establishment of the CUNY Institute CoSSMO?

- To act on a **unique opportunity** at timely fashion.
- Because CoSSMO will raise the profile of the other CUNY Institutes and Centers that support its creation: the Institute for Sustainable Cities (CISC), the Institute for Software Design (CISD), the Institute for Urban Systems (CIUS), The Academic Center for Excellence in research and Teaching (ACERT), etc.
- Brown University has already started a similar venture (ICERN), but our approach focuses on undergraduate and graduate student involvement in NYC problems: we must capitalize on opportunity.
- To make CUNY **the first** institution that will train students with our integrated ORE approach.

How can a student or a Faculty member participate at CoSSMO?

- Professors, external collaborators and students with active projects in CoSSMO's portfolio will automatically be *affiliated members*.
- A CUNY Professor can be appointed Lead for Outreach, Lead for Research, or Lead for Education, by application supported by the Provost of his or her College.
- CoSSMO will host Resident Scholars in Emerging Technologies, a prestigious position for renowned experts in certain emerging scientific methodologies and computer technologies. This position may be granted to a CUNY tenured professor upon negotiation of teaching release with the Provost of his or her College.

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