IEEE Control Systems Society Outreach Fund

Membership Activities: Reaching Out

As a Society, our mission is to create value for our members. Oftentimes, this takes the form of technical events and publications. However, it is equally important to ensure that we reach out (beyond our standard stomping grounds) and inspire and motivate groups of people that would otherwise not be exposed to the wonders of control theory. As the retiring chair of our Outreach Task Force, Daniel Riviera has supported a number of such activities. In the subsequent column, he summarizes some of these activities, provides the historical context and background to our Outreach Fund, and highlights some examples of the power of reaching out.

**Magnus Egerstedt,
Vice President, Member Activities**

The Outreach Fund of the IEEE Control Systems Society (CSS) provides small (lower than US$20,000) grants to CSS members for outreach activities that will benefit the CSS and the controls community in general. Outreach, broadly speaking, consists of any activity that introduces, promotes, or extends control systems concepts to a new or diverse audience. This includes, but is not limited to, the following:

» activities involving students (at all levels, from K–16 to graduate school)
» activities in developing countries
» educational materials for the CSS or the field
» workshops on control-related topics with an emphasis on outreach (that is, outreach to students and developing nations and also workshops educating communities outside of the field about control systems).

While the CSS Outreach Fund has been mentioned in many past issues of *IEEE Control Systems Magazine* (for example, see [1]), the last time that an article focused exclusively on the fund was in 2014 [2]. This current article provides an overview of the Outreach Fund and its procedures as well as describes recent activities.

HISTORY AND BACKGROUND

The CSS Outreach Fund has been in existence since 2010, having been proposed by then-CSS President Tariq Samad in 2009. Decisions on proposals are made by the Outreach Task Force, which currently consists of Daniel Rivera (chair), Antonella Ferrara, Oscar Gonzalez, Jing Sun (CSS vice president of Finance, ex officio), and Annu Annaswamy (CSS president-elect, ex officio). The late Gary Balas was founding chair of the Outreach Task Force, and Daniel Rivera has served as chair since 2014 (see Figure 1). Antonella Ferrara (subject to CSS Board of Governors approval) will assume chair duties in 2020. Nominally, US$100,000 is budgeted yearly by the CSS for the Outreach Fund. Since the fund's inception, 76 grants have been awarded.

PROCEDURES

Proposals for Outreach grants are requested in two solicitations that are communicated through the CSS e-letter and social media outlets. Proposers must be CSS members. Submission deadlines vary, but they are typically in late May (for the spring solicitation) and late November (for the fall solicitation). A structured-yet-simple four-page application (with instructions that are requested directly from the Outreach chair) must be submitted for consideration. Communication between the proposers and the chair is strongly encouraged prior to proposal submission. A maximum of US$20,000 is the budget limit for a yearlong activity. Student and administrator support are allowed, but no PI support can be included. Overhead costs are limited to a maximum of 10%. While

FIGURE 1 Daniel Rivera, Outreach Task Force chair, giving a presentation on the IEEE Control Systems Society Outreach Fund at the 2017 IEEE Sections Congress in Sydney, Australia, held August 11–13, 2017.

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cost sharing is not required, it is highly recommended. Because of the delays involved in evaluating and administering grants, potential grantees are asked to propose activities that are, at a minimum, eight months in the future (a year or longer is preferable). Receiving an Outreach Fund grant does not imply CSS cosponsorship; cosponsorship should be pursued in a separate process through the CSS vice president of Conference Activities.

SUMMARY OF ACTIVITIES AND TESTIMONIALS

The Outreach Fund page on the CSS website [3] provides a wealth of information regarding the fund, including a report of past- and currently funded activities. A diverse series of projects has been funded over the years in all continents (except Antarctica). One focus of the program has been K–12 science, technology, engineering, and mathematics activities. A recent notable project (Control Systems Education and Outreach to Low-Income High School Students in San Antonio) was led by Ahmad Taha from the University of Texas at San Antonio (see Figure 2). Taha says, "It was truly wonderful to see how young girls enjoyed learning basic control engineering concepts and graciously compete to design simple control algorithms. I am grateful for the CSS Outreach Fund for enabling that and look forward to building on that experience for more outreach activities in San Antonio for minority students."

The Indian Control Conference (ICC) series has benefitted from outreach funding since its inception in 2015 (see Figure 3). The ICC series was granted funding for conferences from 2015 through 2019, and it has made good use of these funds to help its student program. M. Vidyasagar [Indian Institute of Technology (IIT) Hyderabad and the University of Texas at Dallas], who has served as general chair of multiple ICCs, writes the following: "Thus far, about 250 unique students have benefited from travel support thanks to the Outreach Fund. At roughly US\$120–150 per student participant, the ICC easily gives one of the greatest 'bang for the buck' to the Outreach Fund. The Outreach Fund support is about 20% of our total budget, and we would not be able to raise that much money from other sources. The participation of students (around 40%) gives an air of vibrancy to the ICC compared to (for example) the Conference on Decision and Control, where the fraction of student participants is much lower."

The following are quotes from student recipients of travel grants to ICCs enabled by the Outreach Fund.

» "Financial support provided by ICC for registration helped me in participating in the conference. The accommodation for support made my stay at IIT Delhi very comfortable. Overall, the student support program allowed me to focus on conference proceedings and interacting with world leaders in control domain without diverting the focus on financial matters and accommodation."
—Srinivas M.

» "It has been of immense help. The reimbursement of the entire cost of travel/accommodation/
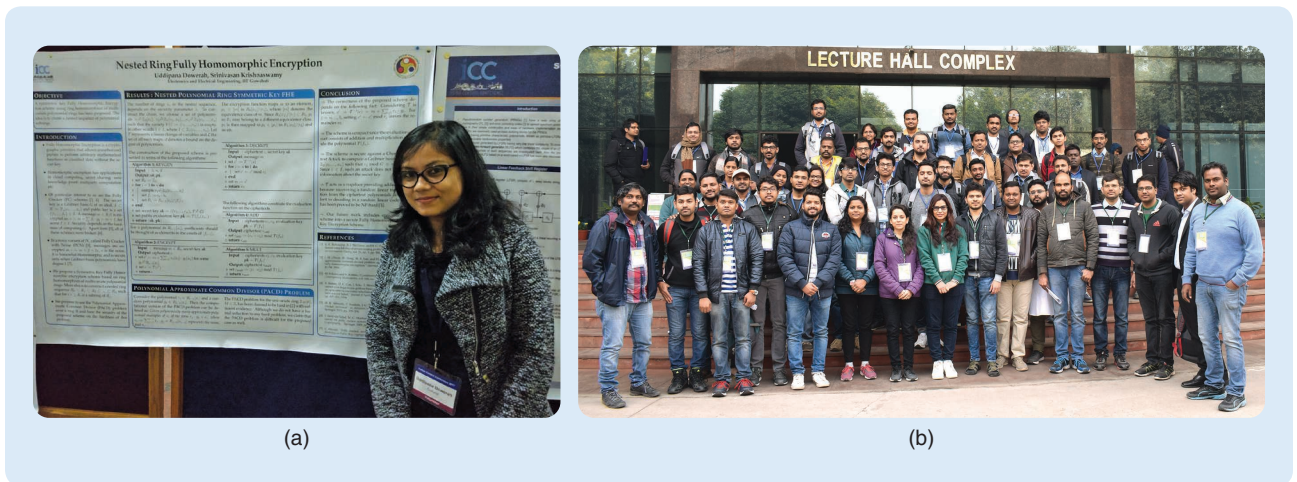

(a)   (b)

FIGURE 2 (a) A team showing its robot and (b) all participants showing their certificates in the outreach project, Control Systems Education and Outreach to Low-Income High School Students at San Antonio, led by Ahmad Taha at the University of Texas at San Antonio.

(a)   (b)

FIGURE 3 The Indian Control Conference (ICC) series has received Control Systems Society Outreach funding to support its student programs: (a) a student presenting her poster during the 2017 ICC at Indian Institute of Technology (IIT) Guwahati and (b) all 51 student participants for the fifth ICC, held at IIT Delhi on January 9–11, 2019.

registration encourages participants to submit papers. I even recommended my juniors apply for the support and am delighted to say that they felt really good at the conference and are motivated to submit papers for future ICC editions."

—Hadhiq K.

» "It provided me the opportunity to attend the conference and listen to various speakers from around the world. It also gave me a platform to interact with fellow researchers and develop professional contacts."

—Mona S.A.

The University of Illinois at Urbana–Champaign (UIUC) Coordinated Science Laboratory (CSL) holds a yearly student-led conference that has also received support from the Outreach Fund (see Figure 4). Philip Paré, currently a postdoctoral scholar at KTH in Stockholm and general cochair for the 12th annual (2017) CSL Student Conference, writes, "The IEEE CSS Outreach Fund has been a vital source of funding for the CSL Student Conference, as it has grown from a small opportunity for CSL students to practice presenting their cutting-edge research (with

around 100 participants) to an interdisciplinary showcase that receives attention from not only all over and around the UIUC campus but also from other top universities and main industry members, with 400, 600, and 800 participants over the last three years."

Other conference series that have received support from the Outreach Fund include the Colombian Conference on Automatic Control (2011, 2015, 2017, and 2019). In 2017, the Outreach Fund provided a grant for 13 researchers from across Africa to attend the Control Conference Africa,

held in Johannesburg, South Africa. A recent Outreach-funded activity that is enabling students from developing countries to build skills in control systems is a grant to the European Embedded Control Institute International Graduate School on Control 2019, led by Francoise Lamnabhi-Lagarrigue (CNRS and the University of Paris-Saclay). Lamnabhi-Lagarrigue shares, "The CSS Outreach funding represents an invaluable help for Ph.D. students from developing countries for allowing them to attend a module of the reputed International Graduate School on Control for a week. Besides

FIGURE 4 A robotics demonstration session (open to the public) as part of the University of Illinois at Urbana–Champaign's 12th Coordinated Science Laboratory Student Conference, held in 2017. The items on the table are winged robots, and the girls (center) talking with the graduate student are middle school and high school students attending the event.

FIGURE 5 (a) Participants in the Outreach-funded Innovations in Predictive Control Workshop, held at Indian Institute of Technology Bombay on November 25–29, 2018. (b) John Lygeros of ETH Zurich giving a spirited presentation at the workshop.


FIGURE 6 A cheerful group of student participants from a hands-on control experiments session that was part of the Central American Workshop on Advanced Process Control, held at the University of Costa Rica on February 13–15, 2019.

high-level instruction, this gives them an exceptional opportunity for intense exchanges with renowned experts, to meet other Ph.D. students from all over the world, and to discover the arcana of a university abroad."

The CSS Outreach Fund has also funded focused workshops in developing countries with emerging economies. One recent example is the Workshop on Recent Innovations in Predictive Control, held at IIT Bombay and organized by Daniel Quevedo, Debasish Chatterjee, and Vivek Borkar on November 25–29, 2018 (see Figure 5). Below are a few comments from student participants at the workshop:

» "It was really a nice experience. I really thank you for this."

» "I have never attended a workshop with so many experts in my field. Thank you so much for organizing the Innovations in Predictive Control. There were no delays in starting the talks. The food was great, especially the gala dinner.… Overall it was a great experience. Thank you once again."

» "I would like to thank you for providing this wonderful opportunity and a platform to interact with the speakers. I am glad that I found a new area in the control domain, mostly in stochastic, data-driven predictive control. I am glad that I attended the workshop."

» "Needless to say, listening to lectures by the world-renowned experts in this workshop was a great opportunity. Thanks to the organizers for arranging such a workshop."

» "This is the first time I am attending a workshop after entering research, and I must say this was an awesome experience. To meet such legendary professors and to experience such a collaborative atmosphere was really an honor. Although many topics were quite new to me, the exposure I got from them was really amazing."

Another recent workshop assisted by an Outreach grant was the
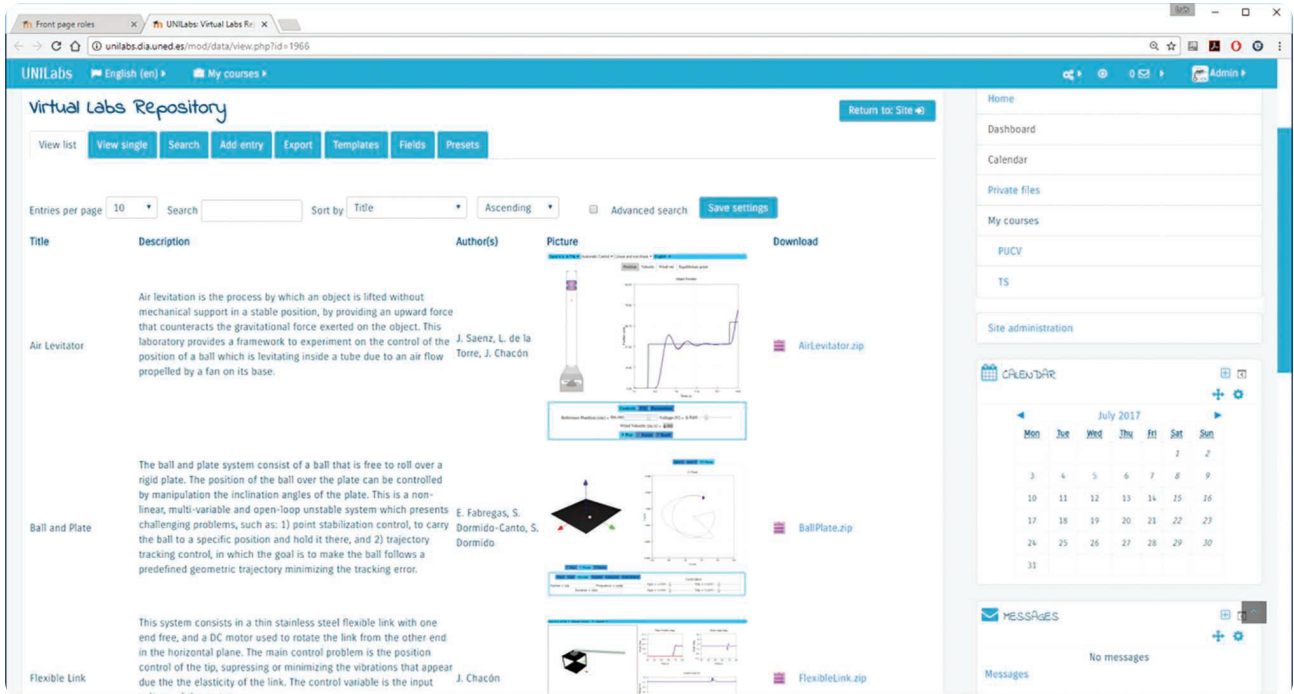
FIGURE 7 A listing of activities by Sebastián Dormido of the National University of Distance Education in Madrid (as part of the Outreach project Open and Virtual Remote Labs for Control Education) which can be accessed by the general public at https://unilabs.dia.uned.es.

Central American Workshop on Advanced Process Control (see Figure 6), held at the University of Costa Rica (UCR) in San José on February 14–15, 2019 (http://sites.ieee.org/acw-2019). Ramón Vilanova Arbós of the Universitat Autónoma de Barcelona and Orlando Arrieta, dean of the UCR School of Engineering, were the conference organizers and Outreach project proposers.

The Outreach Fund also supports activities that bring together different communities to provide insights into novel applications and implications of control systems. Such was the case with an interdisciplinary panel session with distinguished scientists devoted to the interface between control engineering and social science ("Interface Between Engineers and Social Scientists: Low-Hanging Fruits, Language Barriers, and Synergy"), organized by Sandra Hirche (Technische Universität München), Anu Annaswamy (Massachusetts Institute of Technology), and Dawn Tilbury (University of Michigan), that was part of the second IFAC Conference

on Cyber-Physical and Human Systems, held in Miami Beach on December 14–15, 2018 (see page 84 of this issue for a report on this event).

Another class of Outreach grants stems from the development of computer-based tools to help disseminate control engineering concepts. Here, the project Open Virtual and Remote Labs for Control Education (led by Sebastián Dormido of Spain's National University of Distance Education) is an illustrative example (see Figure 7). He comments, "We are very grateful to the CSS Outreach Task Force for the funding it provided to our proposal. This allowed us to develop a versatile low-cost experimentation platform, the Air Levitation System, which was designed and built from scratch. It can be used as a standalone laboratory, connected directly to the student PC or laptop, or it can be combined with a Raspberry Pi or another single-board computer to build a remote laboratory. The latter approach has been pursued at our university, incorporating several instances into the labs' network UNILabs. We are
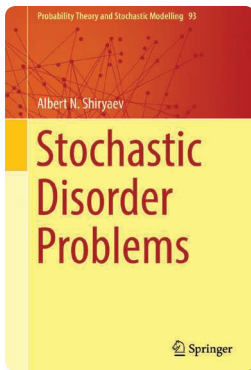
working to share this remote laboratory with other Spanish and Ibero-American universities with whom we maintain a relationship in this area."

KEYS TO SUCCESS IN HAVING A FUNDED OUTREACH PROPOSAL

As noted previously, establishing an early initial dialogue with the Outreach Task Force chair is strongly encouraged prior to proposal submission. Many potential activities unfortunately cannot be considered because they are brought to the task force too late in the process. Furthermore, an early dialogue with the chair will help proposers write applications that better align with the sensibilities and priorities of the task force.

Once submitted, proposals are carefully reviewed by the task force and discussed in a face-to-face meeting held either at the American Control Conference (spring solicitation) or the IEEE Control and Decision Conference (fall). While there is not one single formula for success,
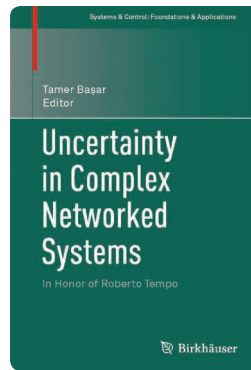
Stochastic Disorder Problems

by A.N. SHIRYAEV

This monograph focuses on stochastic quickest detection tasks in disorder problems that arise in the dynamical analysis of statistical data. These include (among others) the quickest detection of randomly appearing targets and arbitrage in financial mathematics. There is also interest in quickest detection methods for randomly occurring intrusions in information systems and the design of cyberattack defense methods. The book shows that the majority of quickest detection problems can be reformulated as optimal stopping problems, where the stopping time is the moment the occurrence of disorder is signaled. To this end, considerable attention is devoted to the general theory of optimal stopping rules. The exposition also covers both the discrete-time and continuous-time cases.

Springer, 2019,
ISBN: 978-3-030-01525-1,
397 pages, US$119.99.

Uncertainty in Complex Networked Systems: In Honor of Roberto Tempo

by T. BAŞAR, Editor

The chapters in this volume celebrate the life and research of Roberto Tempo, a leader in the study of complex networked systems. At least one author of each chapter was a research collaborator of Tempo's. This volume is structured in three parts. The first covers robustness and includes topics such as time-invariant uncertainties, robust static output feedback design, and the uncertainty quartet. The second part focuses on randomization and probabilistic methods, covering topics including compressive sensing and stochastic optimization. Finally, the third part deals with distributed systems and algorithms and explores matters involving mathematical sociology, fault diagnoses, and PageRank computation. Each chapter aims to identify fruitful future directions in research. This book should serve as a useful reference volume for researchers interested in uncertainty, complexity, robustness, optimization, algorithms, and networked systems.

Birkhauser, 2018,
ISBN: 978-3-030-04629-3,
618 pages, US$139.99.

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compelling proposals clearly articulate how the proposed activity constitutes outreach. Strong proposals also provide substantive dissemination plans for outcomes and have an outward (rather than inward) focus. The winning proposals usually include students in meaningful ways and discuss how grant funds will be leveraged for activities that constitute a win-win for participants, the proposing organization, and the CSS.

Once recommended by the Outreach Task Force, a proposal will require additional approval from the IEEE vice president of Technical Activities. Grants are processed as gifts through the IEEE Technical Activities operations group. Final reports are expected within 60 days after project activities are completed; these are made available on the Outreach Fund website. Many grantees find that their final reports can be repurposed as conference or activity reports that are then published in a future issue of *IEEE Control Systems Magazine.*

CONCLUDING REMARKS

The CSS Outreach Fund has evolved from its origins in 2010 to become an established mechanism for promoting control systems principles, educating students, and enhancing diversity within the CSS. A collective source of information on the Outreach Fund can be found at http://ieeecss.org/activities/control-systems-society-outreach-fund-0. The website includes the deadline for the upcoming solicitation. Announcements are usually made monthly, starting three months prior to the deadline, in the CSS e-letter. Questions and inquiries regarding the Outreach Fund should be directed to Daniel Rivera, Outreach Task Force chair, at daniel.rivera@asu.edu.

Daniel E. Rivera

REFERENCES
[1] F. Bullo, "Nurturing diversity and reducing implicit evaluation bias," *IEEE Control Syst.*, vol. 38, no. 4, pp. 8–13, Aug. 2018.
[2] G. Balas, "IEEE Control Systems Society outreach fund," *IEEE Control Syst.*, vol. 34, no. 1, pp. 18–20, Feb. 2014.
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