IEEE Control Systems Society

Technical Committee on Healthcare and Medical Systems

Biannual Report

TC Chair: Caterina Scoglio

Date: November 2016

Reporting period: June 2016 – November 2016

SUMMARY

In the last 6 months, the TC on Healthcare and Medical systems has continued previously started activities and initiated collecting content to enrich our webpage. New members have joined the TC, and an effort to implement efficient organization of the committee is ongoing. Several special and invited sessions have been proposed to ACC and CDC.

MEMBERSHIP

The number of members has increased in the past 6 months to a total number of 48 members.

CONFERENCES

TC-sponsored activities during the ACC 2016 in Boston

This TC has organized two invited sessions, with all papers presented and well received.

- *Mathematical modeling of diseases and medical intervention effects.* (WeB12) Organizers: Caterina Scoglio, Kansas State University, and Alexander Medvedev, Uppsala University Sweden. The proposed invited session is aimed at demonstrating the diversity of mathematical techniques that are applied in modeling of diseases as well as the assessment of intervention therapies and strategies.

- *Application of control theory in legged locomotion.* (ThC10) Organizers: Robert D. Gregg, University of Texas at Dallas, and Koushil Sreenath, Carnegie Mellon University. Co-Endorsed by the TC on Manufacturing Automation & Robotic Control. The goal of this invited session is to bring together leaders in control of legged locomotion, from the controls, dynamics and robotics communities, to foster a single session for exchanging ideas to enable complex experimental systems to exhibit dynamic legged locomotion.

This TC has also organized a special session

- *Role of controls and systems science in health-related research*. Organizers: Caterina Scoglio, Kansas State University, and Fahmida N. Chowdury, National Science Foundation. This session will consist of one introduction, four presentations, and a panel

discussion with audience participation. The motivation for the session is that in the recent years, the scope of controls systems science has expanded considerably in the field of health-related research. This session will serve three purposes: (i) introduce the audience to examples of the application of control theory and related tools for health-related research, specifically for treatment and management of diabetes; (ii) present some funding opportunities in this type of multidisciplinary research, and (iii) have an open dialogue about the difficulties of collaborative research between such traditionally disparate fields.

TC-sponsored proposed activities during the IEEE CDC 2016, Las Vegas

This TC had submitted the following invited session proposal:

- *Automatic Control of Therapies.* Proposers: Alexander Medvedev, Uppsala University Sweden, Pasquale Palumbo, CNR-Italy, Caterina Scoglio, Kansas State University. This invited session on automatic control of medical procedures has attracted papers that deal with theoretical as well as practical challenges of the field. In particular, papers covering such aspects as therapeutically relevant control performance criteria, suitable controller design principles and system architectures, the safety of automatic control in medicine, implementation of predictive action, parameter and state estimation of biomedical systems for control are accepted contributions of this session.

Unfortunately, the proposal for the invited session was rejected. However, of the six submitted papers of the invited session, three of them have been accepted and will be included in the final proceedings.

TC-sponsored activities during the ACC 2017 in Seattle

This TC has submitted the following invited session proposal:

- *Computational models in health and care* Proposers: Caterina Scoglio – Kansas State University, Alexander Medvedev – Uppsala University Sweden. This proposed invited session consists of papers addressing problems in medicine and care of high societal impact by applying mathematical and computational modeling of processes and systems. The presented concepts cover continuous, discrete, and hybrid mathematical models, data-driven as well as derived from first principles. Additionally, current availability of large amount of data has open the door to new and personalized approaches to medicine based on computational intelligence. The topics of interest include but not limited to cancer, infectious, neurological, and cardiovascular diseases, diabetes, obesity, and frailty.

While six contributions were planned for this invited session, one author could not submit at the last moment due to health reasons. Currently, the invited session includes five contributions. We have informed the Vice Chair for Invited Sessions, Dr. Kristi Morgansen of this situation.

OTHER ACTIVITIES

Alexander Medvedev, Daniel Rivera, and Caterina Scoglio, members of this TC, are part of the proposers of a *Special Issue for the IEEE Transactions on Control Systems Technology*. The proposed title of the special issue is "Control and data-driven modeling in biomedicine", and it is sponsored by the IEEE CSS Technical Committees on 1) Healthcare and Medical Systems, 2) System Biology, 3) System Identification and Adaptive Control.

The purpose of this special issue is to bring together researchers working on system identification and automatic control with applications to systems biology and medical/healthcare systems to see what the two communities can learn from each other's experiences.

Topics of common interests include but are not limited to the following:

- theoretical and implementational challenges that arise in medical and biological systems,
- control engineering tools for solving specific system design problems in medical technology,
- existing and new data-driven modeling techniques capturing the dynamics of biomedical systems and taking into account intra- and inter-individual variability,
- evidence of successful projects in biomedical technology enabled by system identification and control,
- application areas in healthcare and medical systems, such as assistive devices and therapeutics in medical rehabilitation, mathematical and simulative models of infectious diseases spreading, treatment and management of diabetes, artificial pancreas, closed-loop anesthesia, and control of legged locomotion.
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This proposal is still being evaluated by TCST.