

## The Inaugural CDC Soccer Cup

During the 2018 IEEE Conference on Decision and Control (CDC) in Miami Beach, Florida, the social program was augmented with an unofficial event that nonetheless garnered lots of enthusiasm and excitement from the attendees: the inaugural CDC Soccer Cup. This high-powered and exciting event took place on December 17, 2018, 1–3 p.m. In this column, we describe the organization and offer an analysis of the first ever CDC Soccer Cup game.

### BEFORE THE MATCH

The origins of the cup go back several years to multiple informal conversations among the authors about how much fun it would be to organize a match at one of our major conferences. After earlier attempts failed to come to fruition (from a mixture of injuries and our questionable time-management skills), prodding from Rick Middleton (who had signed up already for the not-meant-to-be 2017 CDC Soccer Cup) and Frank Doyle (who agreed to referee the game) got the ball rolling. Magnus Egerstedt served as the Local Arrangements chair for the CDC Cup and handled the logistics of finding a venue. Mihailo Jovanovic and Jorge Cortes acted as team captains and were in charge of recruiting players.

To prevent things from getting out of control, early on in the organization, we decided that this had to be a by-invitation-only event. Word of mouth spread quickly, and soon, the list of participants was full with 32 names. Many people who were invited but who had not made plans to attend the CDC for a variety of reasons expressed dismay at missing the event. A distinguished member of our community even acknowledged that, after months of politely declining meeting invitations and committee requests because “unfortunately, I won’t be at

CDC,” this was the first time that this person (who shall remain nameless) truly meant it.

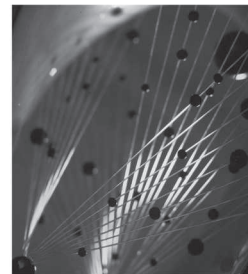
Because the majority of the participants were slightly past their physical prime, it was decided to not invite graduate students or postdocs. The difference in age and stamina might have made the game too challenging for old timers, and it would have prevented the game organizers from looking good (we also did not want people to get injured, but more about that later). Participants self-reported their skill levels (level 1, still plays actively; level 2, used to play but hasn’t touched a soccer ball in years; and level 3, was probably invited to participate in the CDC Cup by mistake) and preferred field positions, which allowed the team captains to create two balanced teams of 17 people each.

The white team (Kalman FC) was composed of (in alphabetical order) Francesco Bullo, Captain Cortes, Emiliano Dall’Anese, Warren Dixon, Bahman Ghahesifard, Jonathan How, Raphael Jungers, Laurent Lessard, Enrique Mallada, Girish Nair, Gabor Orosz, Miroslav Pajic, George Pappas, Victor Preciado, Giordano Scarciotti, Shreyas Sundaram, and Yorai Wardi. The black team (Lyapunov United) included James Anderson, Alessandro Astolfi, Carolyn Beck, Geir Dullerud, Magnus Egerstedt, Matt Hale, Captain Jovanovic, Jerome LeNy, Daniel Liberzon, Cameron Nowzari, Thomas Parisini, Jorge Poveda, Ricardo Sanfelice, Peter Seiler, Rodolphe Sepulchre, Ahmad Taha, and Michael Zavlanos.

Cortes, the captain of Kalman FC, took preparations for the game a bit too seriously. He gave homework to his team, sending [1] as a reading assignment prior to the match, and drawing attention to intriguing technical tools, such as the entropy metric and the confrontation matrix. Jovanovic, the captain of Lyapunov United and a skilled soccer player himself, relied more on experience, instincts, and strategic

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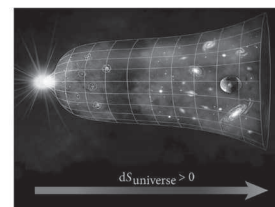
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The participants of the inaugural CDC cup.

use of trash talking. Scouting for the other team's initial formations proved to be a full-time activity in the hours prior to the match in the corridors of the conference hotel. In an attempt to assert his authority, Doyle was seen brandishing his red card already during the IEEE Control Systems Society (CSS) Board of Governors meeting.

The players and several die-hard fans met in the lobby of the conference hotel 45 min prior to the match and walked together to the field. It turned out that Egerstedt had failed to properly investigate its dimensions. Instead of supporting a full 11 versus 11 lineup, the rather narrow pitch forced the team captains to adapt

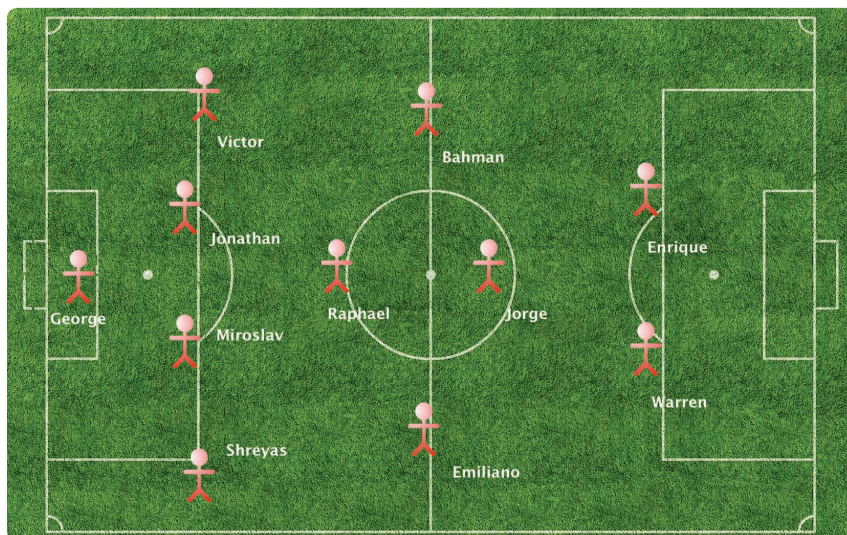
their plans to a nine versus nine set-up. The game turned out to be epic nonetheless.

### THE MATCH ITSELF

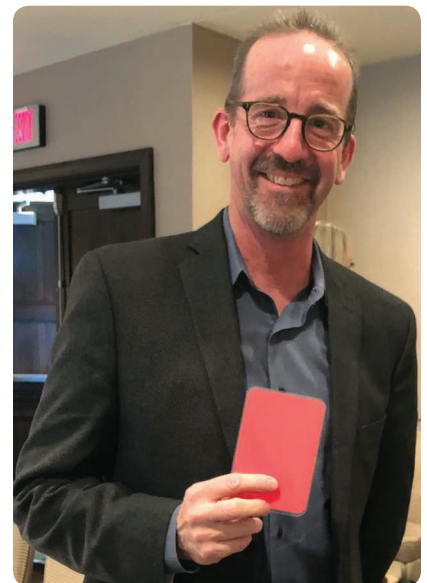
The format for the game was optimized to encourage sportsmanship and camaraderie and prevent heat stroke and injuries. This meant that unlimited substitutions were allowed on the fly, and the referee had a zero-tolerance policy for dangerous plays. As the game started, it became clear that the unusual field dimensions, combined with the even more unusual soccer abilities of the participants, resulted in a somewhat chaotic version of the beautiful game. One

particularly odd aspect was provided by the low fences surrounding the field: the players had to climb them on multiple occasions to retrieve errant balls, and the ball ended up in the Miami Beach Canal twice during the game.

Anchored by a smothering mid-field, Lyapunov United was up 2–0 at halftime thanks to an unsaveable bullet by Sanfelice and a delicate little number by Astolfi. Kalman FC responded with a careful set of substitutions, and a thorough halftime



Jorge Cortes took his captaining a bit too seriously.



Frank Doyle was keeping his red card handy during the Control Systems Society Board of Governors meeting the day before the game.



Lyapunov United lifts the CDC Cup trophy (a paper cup) after a 5–1 victory over Kalman FC.

review process led to a more balanced game at the beginning of the second half. This carefully conceived strategy led to the first-ever presidential goal early on in the second half by none other than 2018 CSS President Bullo, who elegantly (and in slow motion) weaved his way through the Lyapunov United defense. Rumors immediately started circulating that he had been allowed to score the goal as a way to curry favor with the Society's president.

As the game was about to get even, Egerstedt managed not only to score a second half hat-trick, bringing the score to 5–1 toward the end of the game, but also receive the game's only yellow card as he politely offered to let the referee borrow his glasses so he could "see things more clearly." During the final seconds of the game, Kalman FC had a chance to reduce the lead through a penalty kick that ultimately did not result in a goal. Consequently, the first ever CDC Soccer Cup ended 5–1 to Lyapunov United.

Because the organizers had not fully thought through what the cup

**The CDC Cup attracted as much attention as the actual conference on social media.**

actually should look like, a highly prestigious paper cup was found, and Lyapunov United captain Jovanovic was handed the trophy for safekeeping until 2019. In addition to the trophy, referee Doyle handed out a sportsmanship award to the player who best exemplified the spirit of the game. The winner of the sportsmanship trophy was Parisini, who was commended for calling fouls on himself throughout the game, although maybe he was just tired and needed a break.

#### **AFTER THE MATCH**

If Twitter and Facebook are any judge, the CDC Cup attracted as much attention as the actual conference on social media, including a stream of pictures with controls researchers at various degrees of exhaustion on the soccer field. There

was a robust and all-around positive vibe around the game, and as a community-building activity, the CDC Cup was an unqualified success. As a consequence, it was decided that there would be the 2019 CDC Cup in Nice, France, as well.

One unfortunate outcome of the match was that, in spite of our best efforts, several injuries took place. The editor-in-chief of this very publication, How, suffered a mysterious muscle strain in his leg early in the game. As a result, he was seen limping up on the stage during the IEEE CSS Awards Ceremony (to be recognized as a newly elected IEEE Fellow). Additionally, one player got a mild concussion after taking an errant ball to the head. (To be honest, it is sometimes hard to tell if a controls researcher has

*(continued on p. 39)*

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- *IEEE Control Systems Society experience highlights:* Board of Governors (2016); associate editor, *IEEE Transactions on Control Systems Technology* (2004–2011); guest editor, *IEEE Transactions of Control Systems Technology* (2001, 2007, and 2012); program chair, IEEE Multi-Conference on Systems and Control (2015); chair, IEEE Transactions of Control Systems Technology Outstanding Paper Award Committee (2015–2017), Control Systems Technology Award Committee (2018–2020).
- *Notable awards:* IEEE Transactions on Control Systems Technology Outstanding Paper Award (2007 and 2018); Control Systems Technology Award (2009); Fellow, IEEE, International Federation of Automatic Control (IFAC); IFAC Nathaniel B. Nichols Medal (2014).

being taught at several other institutions in the United States, although not as many as I was expecting. That said, some of the topics involved are covered in other courses in nearly every institution that offers a controls specialization. However, given the importance of Kalman filtering, I decided that we needed a dedicated graduate course.

I developed a graduate course on the dynamics and control of MEMS.

This course provides a comprehensive overview of MEMS devices and their control systems, including MEMS fabrication processes; sensing and actuation techniques in MEMS; modeling and system identification of MEMS dynamics; and control, signal processing, and interface electronics design for MEMS transducers. We covered a number of case studies (such as MEMS accelerometers, gyroscopes,

force sensors, pressure sensors, and nanopositioners) in detail. In addition to learning these topics, students gained hands-on experience with MEMS transducers and real-time controller implementation. The class was divided into groups of four students, each group was assigned a mentor, and each group was given a two degree-of-freedom MEMS nanopositioner to work with. Students then built read-out and drive electronic circuits for their MEMS devices and performed system identification to obtain a model of the system. Each group then designed a two-input, two-output control system to track a zig-zag raster pattern in 2D and implemented the controller in dSPACE in real time. At the conclusion of the course, students produced a six-page report (in the ACC format) that detailed their work. Teaching this course was a lot of fun, and, as you would expect, a lot of work, mainly due to the lab component.

### Q ■ Thank you for your comments.

*Reza:* Thank you. It's always a pleasure to speak with you, and I would like to use this opportunity to thank you for the service you're providing to our community.



## » MEMBER ACTIVITIES (continued from p. 19)

a concussion. This particular player was quizzed multiple times during the rest of the conference about basic personal data, such as the names and number of his children, and he begrudgingly gave accurate answers. Another player popped his shoulder out of its socket, which resulted in a visit to the emergency room without further consequences.

We have been assured that there were no lingering effects from these injuries, and we look forward to an injury-free 2019 CDC Cup. The widespread muscle soreness could not be avoided, though; virtually all

players suffered from it the day after the game. One could easily spot the game participants among the conference attendees by their varying degrees of limping. However, they all carried their limping as a badge of honor.

In hindsight, there were a number of local arrangements issues that could have been improved upon, such as not waiting to the last second to start planning for the game and recruiting players, ensuring that the field was the proper size, increasing female participation, and bringing a first-aid kit to the game. In spite of

these minor hiccups, the inaugural CDC Soccer Cup was a great success—perhaps more socially than athletically—and we look forward to the 2019 iteration in Nice, France!

**Jorge Cortes**  
**Magnus Egerstedt**  
**Mihailo R. Jovanovic**

## REFERENCE

- [1] Y. Wu et al., "ForVizor: Visualizing spatio-temporal team formations in soccer," *IEEE Trans. Vis. Comput. Graphics*, vol. 25, no. 1, pp. 65–75, Jan. 2019.

