Excerpt from OP-SF Net

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Subject: Report on: II Orthonet School in Madrid, Spain, by Bonneux

The Instituto de Ciencias Matemáticas and the Orthonet network organized the II Orthonet school as part of the thematic program *Orthogonal polynomials and special functions in approximation theory and mathematical physics*. The school took place at ICMAT (Madrid, Spain) at the end of October and can still be classified as a summer school, since it was above 25℃ [77 °F] during the entire week. I attended all four advanced courses in orthogonal polynomials and approximation theory. For completeness, the I Orthonet school took place in Sevilla, Spain, in November 2016.

On Sunday, I went to Madrid, together with the rest of the Belgian delegation, to begin the summer school. While travelling to the residence which was located near the campus, we spotted a lot of Spanish flags which stressed the Catalan crisis. The research center, where no student classes are organized, is located a bit outside the city center, and is therefore very quiet on a Sunday evening.

Figure 1: Group picture.

The school started on Monday and the organizers David Gómez-Ullate and Antonio Durán introduced the speakers. Arieh Iserles (DAMTP, Cambridge University) gave the first lecture about quadrature. Next, Robert Milson (Dalhousie University), who had travelled quite a bit, introduced exceptional orthogonal polynomials. In this research domain, the classical Hermite, Laguerre and Jacobi operator are extended to exceptional operators. These two lectures were followed by the typical Spanish siesta. In the afternoon, Walter Van Assche (KU Leuven) taught his first lecture about random matrices and Riemann-Hilbert problems. These last two topics were my main reason for joining this summer school.

On the second day, the same courses continued and went further into their theory. Arieh Iserles discussed recent work on quadrature of highly oscillatory functions and therefore tackled some very technical results. Robert Milson started to classify exceptional orthogonal polynomials as he (and collaborators) proved recently that exceptional polynomials only pop up when you start from a classical operator and apply a finite number of Darboux transformations on it. After the long break, Walter Van Assche treated the Riemann-Hilbert problem for orthogonal polynomials. In conclusion: all talks on the second day dealt with orthogonal polynomials and thus reflected the theme of this

summer school very well. In the evening, we played some pool at the residence and enjoyed the sunny evening.

On Wednesday, Iserles went further into technical details. Although, his enthusiasm triggered us to keep paying attention during the full ninety minute lecture. Next, Milson, who was now fully recovered from his jetlag, explained how operators with rational coefficients still can have an infinite number of eigenpolynomials. At the end of the day, Walter talked during his lecture about how he had a cold despite the beautiful weather. "Is that a drop of water on my nose? No, it's not! You get it? Snot." This was one of the many jokes that he told during his lectures. This helped me to pay attention, even though it was already a long day containing a lot of new and interesting material.

On Thursday, a new speaker arrived at the summer school, Luis Velázquez (Universidad de Zaragoza). He talked about the connection of orthogonal polynomials in random walks and quantum walks. After the lectures, David Gómez-Ullate invited us to visit the city center. We went by train and metro (ruled by different entities). We discovered a couple of famous places in Madrid. "For more touristic details, just visit Wikipedia," as David said. We went to a couple of bars, and the last bar was owned by a friend of David's. It was there that we learned that the organizer of this school was a famous rugby player (a long time ago). We ate some tapas (typically Spanish), and we arrived back at the residence close to midnight! On Friday morning, me, the other members of the Belgian delegation, and just a few others, attended the last lecture of Iserles. Since there was such a small audience, one can conclude that the trip to the city center was a success. After the morning lecture, Velázquez gave two more lectures about random and quantum walks. His slides were very colorful and funny. For example, all main characters of the Simpsons were present in his slides. If you don't believe me, you can check the slides on all topics here: https://www.icmat.es/RT/optrim/school/lectures.php.

Figure 2: From left to right: W. Van Assche, M. Stevens, N. Bonneux and M. Leurs.

On Friday evening, Walter remembered that he had brought Belgian chocolates for David. Nevertheless, we already said goodbye to him and therefore we got to eat this delightful treat ourselves [Note from editor: isn't that convenient?]. To end this week, we (the Belgian delegation) played the card game 'Oh hell' with Robert Milson and a few other participants. Of course, we added some special Belgian rules to optimize the fun.

One small peculiarity to end this report with: Dinner in Madrid is served around 20:30. This is a Spanish habit which is quite strange for us Belgians. We usually eat somewhere between 18:00 and 19:00. After a week, we finally got used to this and realized that it was time to return home. So, on Saturday, we flew back to Belgium, just as Carles Puigdemont [the Catalan nationalist politician] did a few days later!

The II Orthonet School in Madrid, Spain, was a very useful school which offered advanced lectures involving orthogonal polynomials. My attendance here will definitely improve myupcoming research in exceptional orthogonal polynomials. I hope to visit Madrid again during my PhD. More information on this extremely well-organized, useful, and fun school can be found at: https://www.icmat.es/RT/optrim/school.