Report of the jury of the Stieltjesprijs academic year 2018-2019

The jury for the Stieltjes Prize met on Tuesday 17 December 2019 to award the prize for the best mathematical dissertation published in the academic year 2018-2019.

The jury consisted of Erik van der Ban (UU), Odo Diekmann (UU), Aernout van Enter (RUG, chair), Richard Gill (UL), Frans Oort (UU), Marc Uetz (UT) and Kees Vuik (TUD), with assistance from Marieke Kranenburg (UvA, secretary). A total of 88 dissertations were assessed this time. External advice was obtained at various stages of the assessment. After an initial selection, a shortlist of 12 dissertations was drawn up.

The jury was impressed by the high level of the dissertations. After the first round of discussion, 5 dissertations remained; all 5 of those candidates would have been worthy winners of the Stieltjes Prize. In determining the final winner, the jury focused on the extent to which the candidate's work has added new knowledge to the field of mathematics, on the mathematical depth of the contribution, the quality of presentation and the productivity. Based on this, the jury unanimously proposes to award the Stieltjes Prize for the academic year 2018 - 2019 to Ivan Yaroslavtsev.

Ivan Yaroslavtsev received his PhD degree cum laude, at the Technical University Delft, with supervisors Jan van Neerven and Mark Veraar, for his thesis "Martingales and Stochastic Calculus in Banach Spaces".

The subject of his thesis research lies between the areas of probability theory and (functional and harmonic) analysis.

Martingales are stochastic processes where at each given time the future expectation of the random variable equals the at that time existing and known value of that random variable. Martingales have been applied widely, from physics to financial mathematics. The infinite-dimensional generalisation to Banach spaces, however, runs into difficulties, which Yaroslavtsev by an ingenious approach has managed to overcome.

The Banach spaces to which the theory applies have the so-called UMD property, which has been characterised in terms of Hilbert transforms, a.o. by Bourgain. The proper context here turns out to require a weak topology. Yaroslavtsev proves a decomposition theorem of the type proven by Meyer and Yoeurp in the classical case, he derives Burkholder-Davis-Gundy inequalities, and he provides the foundations for a theory of stochastic integration in this generality. By doing this he solves a number of long-standing problems in stochastic analysis.

Despite the rather technical topic, the thesis is written in a clear and accessible manner.

Yaroslavtsev has showed himself to be a very productive mathematician. At the time of his thesis defense, he had authored 16 papers, his thesis of about 300 pages is based on only part of those. He has shown mathematical depth as well as independence He has solved problems which his supervisors had struggled with for a number of years, and according to one expert he has realised the extension of the theory to Banach spaces in this generality " almost single-handedly", and he has displayed substantial mathematical creativity. Experts use terms like "breakthrough", "rare achievement" and "outstanding quality", and the expectation is that the results will have a considerable impact on the field.