

One of the central problems in Probability Theory is to study the supremum of a given stochastic process defined as a family of random variables indexed by a certain set. Although it may be realistic and elementary to measure the average of the highest level of the river or predict the highest concentration of pollution in the air over the next year, a formal answer to questions related to the probabilistic model arising from this type of considerations is quite challenging. The monograph by M. Talagrand's is sometimes perceived as the culmination of many years of research started by R. Dudley and X. Fernique in the 1960s. Nevertheless, it contains a number of extremely interesting questions, which is why it can be considered rather as a broad program for further development of stochastic analysis. The aim of this project is to find answers to two of the questions posed there.

The first concerns Gaussian chaos - a process that is conditionally Gaussian. It is indexed by a finite set of matrices and it is known that its tails depend both on the Hilbert-Schmidt norm and on the operator's norm. M. Talagrand showed that there is an equivalent of Sudakov's minorization in the Hilbert-Schmidt norm, justifying the optimality of the estimation. The natural issue that is the goal of this project is to investigate whether there is a Sudakov's minorization in the operator's norm.

The second issue is related to the Bernoulli process, i.e. the process of random signs. The solution of W. Bednorz and R. Latała to the problem open for over 20 years, which was put forward by M. Talagrand under the name "Bernoulli's conjecture" provides a very subtle reasoning on how to partition the set  $T$  in order to give a lower bound of the Bernoulli process. It reveals a deep relationship between the geometry of set  $T$  and the supremum of this process. Using Rosiński's representation, it is possible to present infinitely divisible processes as a conditional Bernoulli process. It is technically more complicated object than in the Gaussian case, but the apparatus developed by W. Bednorz and R. Latała gives a chance to provide estimates also in this case.

The minor objective is to prove the very elegant inequality regarding the tails of the supremum of a process of random signs with coefficients being the values of the sequence of monotone functions proposed by W. Szatcschneider.