

Introduction to metric entropy and some applications

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The notion of metric entropy was already introduced by Pontryagin and Shnirel-man in 1932. A systematic study - mainly from an approximation theoretic point of view - began in the 1950s, connected the works of Kolmogorov, Tihomirov, Timan, G.G. Lorentz and many others. Since then metric entropy has found numerous fruitful application in diverse areas of mathematics such as analysis (spectral theory), probability (Gaussian processes), statistics and learning theory, information and coding theory.

In this introductory talk we first recall several variants of the notion of metric entropy for sets and operators and its basic properties. Then we discuss a number of relevant examples, techniques, applications and open problems. In particular, relations of entropy to operator ideals, eigenvalues, interpolation, Gaussian processes, diagonal operators, integral operators in Banach function spaces, and Sobolev type embeddings will be mentioned.

Instead of giving the most recent and most general results, we will concentrate on some typical (sometimes classical) results which illustrate the use of metric entropy in the respective areas. For more refined results we will refer to other talks of the workshop.