From linear to nonlinear n-width : optimality in reduced modelling

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The concept of n-width has been introduced by Kolmogorov as a way of measuring the size of compact sets in terms of their approximability by linear spaces. From a numerical perspective it may be thought as a benchmark for the performance of algorithms based on linear approximation. In recent years this concept has proved to be highly meaningful in the analysis of reduced modeling strategies for complex physical problems described by parametric problems. This lecture will first review two significant results in this area that concern (i) the practical construction of optimal spaces by greedy algorithms and (ii) the preservation of the rate of decay of widths under certain holomorphic transformation. It will then focus on recent attempts to propose non-linear version of n-widths, how these notions relate to metric entropies, and how they could be relevant to practical applications.