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## Markov $L^2$ extremal problems with the classical weight functions

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**Abstract:** The well-known Markov extremal problem in the uniform norm on the interval  $[-1,1]$  was discovered at the end of the 19th century by a very famous Russian academician Andrei Andreyevich Markov (1856-1922) as an answer to a question of a great chemist Dmitri Mendeleev (1834-1907). During the period of 130 years, a huge number of papers were published and the theory of extremal problems of the Markov-Bernstein type and many applications of this type of polynomial inequalities were rapidly developed and established. In this lecture we give an account on  $L^2$  extremal problems with respect to the classical weight functions (Jacobi, generalized Laguerre and Hermite weights) on the real line. Beside the new theoretical results we give some new numerical and symbolic methods for finding the best constants in such kind of extremal problems. The corresponding extremal problems on the restricted polynomial classes are also considered.

**Keywords:** Extremal problems, weight function, best constant, orthogonality, orthogonal polynomials, extremal polynomials.

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