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Some examples of eigenvalue problems in mathematical physics

In his 1834 “Essay on the Philosophy of Sciences”, André-Marie Ampère made the distinction between the elementary general physics and the mathematical physics. The first branch of physics was related to observations and experiments. The second branch considered physical laws, correlations with experiments, the explanation of phenomena. Among these problems of mathematical physics, the eigenvalue problems and the Helmholtz equation are fundamental. In this work, we comment on an important and thick memoir written by Siméon Denis Poisson in 1829, “Sur l'équilibre et le mouvement des corps élastiques”, Lord Rayleigh's influence on Erwin Schrödinger, and finally the first attempts of the numerical solutions of the Helmholtz equation with Runge, Liebmann, and R. G. D. Richardson.