

**Title:** The Kato square root problem, and boundary value problems for non-symmetric divergence form equations

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About 1960 Tosio Kato, during his investigation of the evolution of physical systems, was led to pose a key question about the square root of non-symmetric divergence form elliptic partial differential operators. The one-dimensional problem was solved by Coifman, Meyer and myself in 1982, while it was only in 2001 that the question was fully answered by Auscher, Hofmann, Lacey and Tchamitchian and myself. A more general viewpoint was subsequently provided in joint work of mine with Axelsson and Keith.

Recently, these ideas were employed in work by Alfonseca, Auscher, Axelsson, Hofmann and Kim, and in another paper by Auscher, Axelsson and Hofmann, to give conditions for solvability of non-symmetric divergence form elliptic partial differential equations with bounded measurable coefficients and  $L^2$  boundary values. This complements results of Kenig, Koch, Pipher and Toro, and of Kenig and Rule.

I shall survey these applications of harmonic analysis to the study of elliptic pdes.