How half-order time derivatives help us to better understand parabolic equations

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Abstract

In the study of parabolic problems, the prototypes of which are related to the heat operator $\partial_t - \Delta$, an old but often overlooked approach is to decompose the time-derivative into two fractional derivatives of order $1/2$. Depending on ones preferences, this can either be considered "natural" since it brings back the parabolic homogeneity, for instance when the elliptic part is interpreted in the weak sense via a sesquilinear form, or rather "peculiar" as it introduces non-local operators in the context of local equations.

In this talk I shall touch on some recent results that used half-order time-derivatives in a crucial way, placing an emphasis on my own contributions obtained with several collaborators. This includes improvements of time-regularity for solutions to parabolic systems with measurable coefficients of second as well as fractional order, non-autonomous maximal regularity for the related initial value problem, a new approach to parabolic boundary value problems, and the solution of the parabolic Kato square root problem.