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Local time for Gaussian processes as an element of Sobolev space. (English) Zbl 1331.60154
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Summary: We consider local time for a Gaussian process with values in \mathbb{R}^d . We define it as a limit of the standard approximations in Sobolev space. We also study renormalization of local time, by which we mean the modification of the standard approximations by subtracting a finite number of the terms of its Itô-Wiener expansion. We prove that renormalized local time exists and is continuous in Sobolev space under a certain condition on the covariation of the process (the condition is general and includes the non-renormalized local time case). This condition is also necessary for the existence of local time if we consider renormalized local time at zero for a zero-mean Gaussian process. We use our general result to obtain a necessary and sufficient condition for the existence of renormalized local time and self-intersection local time for fractional Brownian motion in \mathbb{R}^d .

MSC:

- [60J55](#) Local time and additive functionals
- [60G15](#) Gaussian processes
- [60G22](#) Fractional processes, including fractional Brownian motion
- [46N30](#) Applications of functional analysis in probability theory and statistics
- [46E30](#) Spaces of measurable functions (L^p -spaces, Orlicz spaces, Köthe function spaces, Lorentz spaces, rearrangement invariant spaces, ideal spaces, etc.)
- [60H07](#) Stochastic calculus of variations and the Malliavin calculus

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