Title: Upscaling interpretation of nonlocal fields, gradients and divergences

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Abstract:
The interrelations between weight-function upscaling (measurement) and the definition of various nonlocal operators is explored. Let $< f > = f*g$ where $f*g$ is the convolution product which represents the effect of upscaling via an instrument (defined by g) on a field variable f and its localized counterpart. Nonlocal field variables are defined and employed for upscaling. In this talk it will be shown via Fourier transform, for judicious choice of the arbitrary function G_p, that $G_p f(x) = < grad\ f > (x)$, where $G_p f\ (x)$ is the nonlocal gradient of f and $grad\ f$ is the classical gradient. Upscaled representations for the adjoint of G_p and the nonlocal divergence are obtained. A nonlocal self-diffusion equation is upscaled and written in terms of nonlocal operators.

Keywords: nonlocal diffusion, nonlocal field variables, nonlocal gradient, nonlocal divergence and upscaling