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Autoconvolution equations of the third kind

For a positive probability density function $p(x)$ on $(0, \infty)$ we define a relative autoconvolution coefficient $k(x)$ by the quotient of its autoconvolution function and the function itself. The inverse problem of finding p from k leads to an autoconvolution equation of the third kind for p

$$k(x)y(x) = \int_0^x y(\xi)y(x-\xi)d\xi \ , \ x > 0 \ .$$

In the lecture an existence and uniqueness theorem for this equation is derived for functions $k(x) \sim A\, x^n, \ n = 1, 2, ...$ as $x \to 0$. Further, smoothness of the solution p for smooth functions k is proved. Finally, the question of ill-posedness and the need of regularization for this inverse problem is discussed. The lecture is based on joint work of the author with L. Berg, B. Hofmann, and J. Janno, respectively.