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Fourier Transform of Semi-Algebraic Functions

In various specific problems in Signal Processing it was known for a long time that “simple” signals can be accurately reconstructed from a small number of noisy measurements. Recently a serious general progress has been achieved in this direction, with a development of non-linear reconstruction methods for “sparse” signals. (Sparse signals are representable by linear combinations in a certain basis with a small number of non-zero coefficients.)

It is important also to study completely non-linear signal models. It turns out that the parameters of “simple” such models also can be accurately reconstructed from a small number of noisy measurements. The reconstruction usually leads to nonlinear systems of equations.

We illustrate the main features of the non-linear model reconstruction in an important special case: here the “non-linear models” are semi-algebraic functions, while the “measurements” are certain their Fourier coefficients.

The resulting reconstruction problem turns out to be closely related with some problems in Algebraic Geometry and Differential Equations.