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Some problems on bilinear oscillatory integrals along curves

Let P be a polynomial and $T_{P,\beta}$ be defined by

$$T_{P,\beta}(f,g)(x) = \int_{-1}^{1} f(x-t)\; g(x-P(t))\, e^{i|t|^{-\beta}} \frac{dt}{|t|}\,.$$

If $\beta > 1$ and P is a homogeneous polynomial, then $T_{P,\beta}$ maps $L^\infty \times L^2$ to L^2. This is a joint work with D. Fan.

This problem was motivated by Hilbert transform along curves and the bilinear Hilbert transform. One crucial point in the proof is the stability of the critical points of the phase function $a\xi t + b\eta t^2 + f(t)$ for some $a, b \in \mathbb{R}$ and C^∞ function. The proof is also based on a TT^* argument and an uniform estimate of a bilinear oscillatory integral proved by Phong and Stein.