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16. Applications

Section 16 c: Materials/Hydrodynamics

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Greengard, Leslie, Courant Institute, New York University, USA
A new version of the fast Gauss transform

The evaluation of the sum of N Gaussians at M points in space arises as a computational task in diffusion, fluid dynamics, finance, and, more generally, in mollification. The work required for direct evaluation grows like the product NM as N and M increase, rendering large-scale calculations impractical. We present an improved version of the fast Gauss transform [L. Greengard and J. Strain, *SIAM J. Sci. Stat. Comput.* **12**, 79 (1991)], which evaluates the sum of N Gaussians at M arbitrarily distributed points in $O(N+M)$ work, where the constant of proportionality depends only on the precision required. The new scheme is based on a diagonal form for translating Hermite expansions and is significantly faster than previous implementations. Numerical examples and applications will be presented.
The work has been carried out jointly with Xiaobai Sun, Duke University.