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A fast Hermite transform. (English) Zbl 1156.65104

Summary: We present algorithms for fast and stable approximation of the Hermite transform of a compactly supported function on the real line, attainable via an application of a fast algebraic algorithm for computing sums associated with a three-term relation. Trade-offs between approximation in bandlimit (in the Hermite sense), and size of the support region are addressed. Numerical experiments are presented that show the feasibility and utility of our approach. Generalizations to any family of orthogonal polynomials are outlined. Applications to various problems in tomographic reconstruction, including the determination of protein structure, are discussed.

MSC:
65R10 Numerical methods for integral transforms
44A15 Special integral transforms (Legendre, Hilbert, etc.)
92C55 Biomedical imaging and signal processing
92D20 Protein sequences, DNA sequences

Keywords: generalized Fourier transform; Hermite transform; orthogonal polynomial transform; three-term recurrence; tomographic reconstruction; protein structure; fast algebraic algorithm; numerical experiments

Software:
FHT; IMAGIC

Full Text: DOI Link

References:
[1] http://www.cs.dartmouth.edu/~rockmore/FHT.htm. This program is free software: You can redistribute it and/or modify under the terms of the Gnu General Public License as published by the Free Software Foundation, either version 3 of the License, or (at your option) any later version.


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