Signal operator algebras framework over distributed signal processing systems

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Problem Formulation

- How to characterize parameter estimators for multicomponent polynomial phase signals used as active sensing waveforms to study information processing aspects associated with the spatio-temporal dynamics of finite dimensional systems.

\[ x[n] = \sum_{n=0}^{K-1} A_K e^{j \sum_{m=0}^{M-1} \alpha_{k,m} n^m}, \quad n \in \mathbb{Z}_N \]

- This is a discrete time formulation but we work with continuous signals too.
Methodology (Operator Algebras)

Information Flow

Polynomial Phase Signal Space (transmitter)

Scattering Channel (medium, target interaction)

Parameter Estimators and Functional Operators (receiver)

Parameter Array Space

Single-component Signal

Multi-component Signal

Parameter Array

Noise Signal

Signal

Flow

Information

Methodology (Operator Algebras)
Application Tools

**Parallel implementation**

MPI Cluster (Komolongma)

**Distributed implementation**

PlanetLab

- C
- MPI
- FFTW
- Matlab®
RESEARCH RESULTS

6-component chirp signal estimation
(3 dB SNR)

6-component chirp signal estimation
(6 dB SNR)

DCFT estimator output
3-component chirp signal

Comparison for DCFT Multi-processor

