New Variables for Iterative Transform Phase Retrieval

A novel approach that provides a more general framework for performing Discrete Fourier Transform (DFT) calculations.

NASA Goddard Space Flight Center has developed alternative computational strategies for the Discrete Fourier Transform (DFT). This approach uses analysis on geometric manifolds to provide a more general framework for performing DFT calculations. This technique also delivers a more efficient implementation of the DFT for applications using iterative transform methods, particularly phase retrieval. Diagonalizing the conventional DFT array introduces new variables that facilitate a decoupling of the conventional variables used in iterative transform phase retrieval.

**BENEFITS**
- Provides a more general framework for performing DFT calculations
- More efficient for applications that use iterative transform methods, particularly phase retrieval
THE TECHNOLOGY
The Discrete Fourier Transform (DFT) is the primary tool of digital signal processing. By defining new variables for iterative transform phase retrieval using a diagonal form of the DFT matrix, the phase retrieval problem appears to decouple in special cases that can increase the computational efficiency of phase retrieval. The current state of the art in increasing the DFT computational efficiency is the Fast Fourier Transform (FFT). In prior art, no acknowledgment of special purpose computational architectures are given, which are common to some digital signal processing applications. The new DFT method exploits a special computational approach based on analysis of the DFT as a transformation in a complex vector space. Traditional iterative transform techniques can be slow to converge; but in this new basis set, the algorithm can decouple to allow a closed form expression in special cases.

APPLICATIONS
The technology has several potential applications:
- Space telescope alignment
- Optical system testing
- Other commercial optical metrology applications

PUBLICATIONS
Patent No: 9075749

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA’s investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

GSC-15935-1, GSC-TOPS-122