SYSTEM AND METHOD OF BEAMFORMING IN PULSE-ECHO ULTRASOUND IMAGING

IITM Technology Available for Licensing

Problem Statement

- Ultrasound imaging is crucial for diagnostics due to its safety, real-time imaging, and high resolution.
- Traditional Conventional Focused Transmit (CFT) has limited lateral resolution except at the focus.
- Synthetic Aperture (SA) techniques like **Synthetic Transmit Aperture (STA) and Multi-element Synthetic Transmit Aperture (MSTA) improve lateral resolution** but suffer from poor signal-to-noise ratio (SNR) and depth penetration.
- The problem is to explore Backprojection (BP) as an alternative beamforming method for SA-based ultrasound imaging to enhance SNR and depth while maintaining high resolution.

Intellectual Property

- IITM IDF Ref. **1595**
- **IN 380859 - Patent Granted**

Technology Category/ Market

Category - Medical Imaging and Healthcare
Applications - Medical Imaging and Healthcare
Industry - Medical Device Manufacturers

Market - The global ultrasound market has an estimated **CAGR of 6.3%** and a revenue size in the of $8.5 billion in 2023.

TRL (Technology Readiness Level)

TRL - 4: Technology validated in lab scale.

Research Lab

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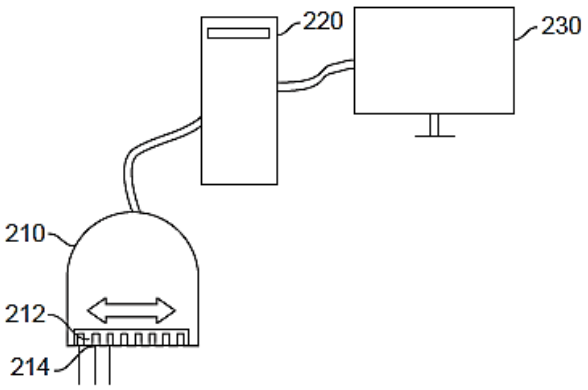

FIG.1. Shows an ultrasonic synthetic array aperture imaging system.

Technology

The present invention discloses a pulse echo ultrasound imaging system and a method of beamforming in the pulse echo ultrasound imaging system.

For a Synthetic Transmit Aperture (STA) transmitting ultrasound diverging beams over a target, reflection data are received and stored in matrices for a plurality of transmit firings. (Fig. 1 & 2)

Image reconstruction is performed by weighting the backscattered echo signal and backprojecting on an ellipsoidal shell and averaging for every combination of transmit-receive pair.

The method implements an elliptical backprojection (EBP) formula that is derived from solving linear wave equation for STA.

For a Multi element Synthetic Transmit Aperture - Diverging beam (MSTA-DB) the eccentricity map is further modified with a virtual source placed behind the transducer. (Fig. 3)

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Key Features / Value Proposition

1. Enhanced Image Quality:
The invention improves image quality by providing better Signal-to-Noise Ratio (SNR) and Contrast-to-Noise Ratio (CNR) compared to conventional methods, making it invaluable for accurate diagnostics.

2. Superior Lateral Resolution:
The method offers superior lateral resolution, ensuring that detailed structures are clearly visualized, aiding in more precise medical assessments.

3.Efficient Data Processing:
By utilizing matrices to store reflection data and implementing an elliptical backprojection (EBP) formula, the system optimizes data processing, enabling efficient and rapid image reconstruction.

4. Adaptability:
The technique is adaptable for both Synthetic Transmit Aperture (STA) and Multi-element Synthetic Transmit Aperture - Diverging beam (MSTA-DB) systems, making it versatile for various ultrasound imaging applications.

5. Competitive Advantage:
This innovation provides a competitive edge in the field of ultrasound imaging, potentially leading to improved patient care and better clinical outcomes.

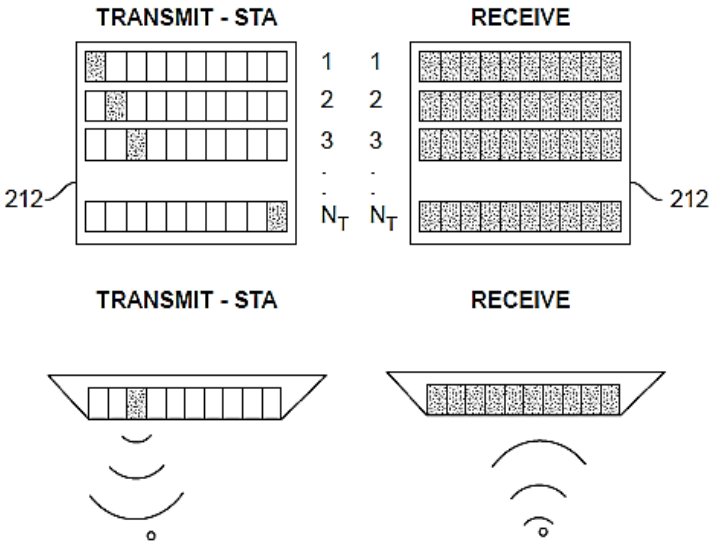

FIG. 2. illustrates a schematic representation of the STA transmit, and a full aperture receive used in STA.

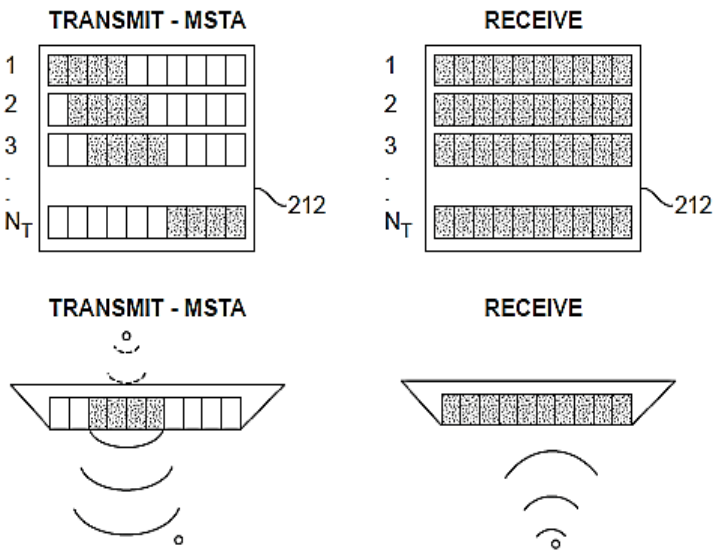

FIG. 3. Shows a schematic representation of the MSTA transmit, and full aperture receive used in MSTA.

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