IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO – IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

METHOD AND APPARATUS TO OBTAIN SUB-PITCH PRECISION IN LATERAL MOTION ESTIMATION IN ULTRASOUND ELASTOGRAPHY

IITM Technology Available for Licensing

Problem Statement

- Lateral Displacement Estimates (LDE) from ultrasound data has several benefits like **obtaining accurate inverse solutions in elastography, improving shear strain elastogram quality, obtaining good quality poroelastograms, reliable rotation elastogram etc.**
- Current methods are reliable only when the imaged medium is homogeneous, or if the displacement continuity is preserved at the boundaries in the case of non-homogeneous medium

Technology Category/ Market

Category – Biomedical Engineering
Applications –Ultrasound techniques,Medical and Surgical, imaging systems,
Industry – Biomedical
Market -The global **medical imaging market size** is expected to grow from $40.33 billion in 2023 to **$61.51 billion in 2030, at a CAGR of 6.2% in the forecast**

Intellectual Property

- **IITM IDF Ref. 1494**
- **IN201641043467**

Key Features / Value Proposition

❖ ***Technical Perspective:***

- **Improvement in precision of LDE** obtained by augmenting true RF A-lines at sub-pitch locations compared to interpolating the post-beamformed RF A-line(**Fig 1A, B, C)**
- The acquired new frame data that includes **pre-compression and post-compression RF data** and is further processed for image formation that may **yield better lateral resolution and lateral displacement estimation (LDE).**

❖ ***User Perspective:***

- The sub-pitch precision in lateral displacement estimates **improve the quality of shear strain elastograms,poroelastograms,rotation elastograms, LSE etc.**
- **Particularly useful in scenarios where targets may move or deform laterally.**

Technology

This method is about **estimating the Lateral (side-to-side) Motion of a Target in Ultrasound Imaging** over a specific time interval "t."

A linear transducer array
"N" elements, separated by distance "λ"
Transducer array sends & receives ultrasound beams using "n" active transducer elements, where "N"> "n"

•An **actuator mechanism** inorder to move the transducer array.

- Involves method that **utilizes data from sub-pitch locations to improve the image quality parameters**
- **Lateral Motion Estimation of a target in ultrasound imaging sub-pitch precision is obtained at a distance half of the pitch (ie. λ/2)** by translating the sub-aperture by activating odd number of consecutive elements and even number of consecutive elements sequentially.

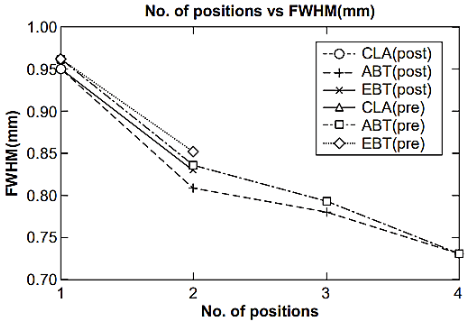

FIG. 1 shows plots of the FWHM obtained in experiments when using RF Aline data from different number of sub-pitch locations by different methods

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- *Two approaches have been used viz.* ***Actuator Beam Translation (ABT) method (pre and post) and Electronic Beam Translation (EBT) method***

Ultrasound beams are transmitted from the transducer elements over a target at the first target position

The transducer array is electronically moved by the actuator to a second transducer location

Transmit Ultrasound Beams at different times to cover the full aperture

Receive Second Data Set at second transducer locations

Formation of Stagger Data Sets that are aligned based on their acquisition times

Beamforming is performed on the staggered data sets to create a beam- formed frame data

Target Deformation and acquiring deformation data sets

Processing for Lateral Motion Estimation

Images

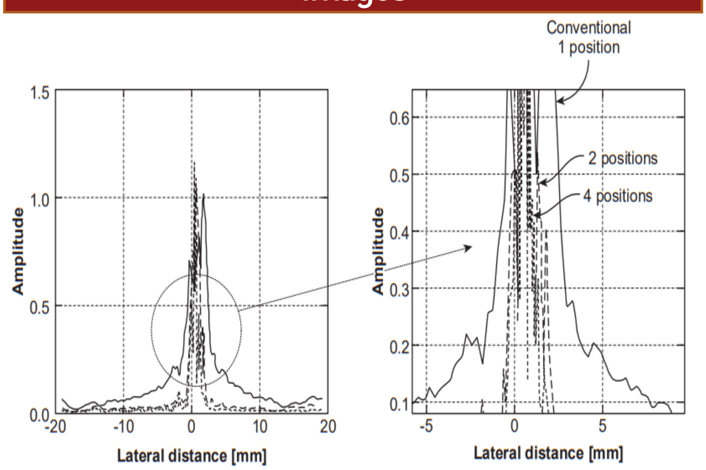

FIG. 2A illustrates the lateral profile at the scatterer location obtained from differentmethods in simulation and **FIG. 2B** shows a magnified view of a region within the plot

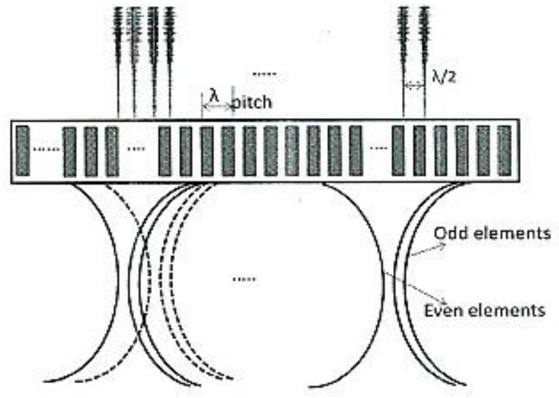

FIG. 3 illustrates a schematic of the **EBT method**, where sub-aperture containing consecutive elements totaling to odd and even number of sub-aperture elements are activated to obtain RF A-line data at sub-pitch locations

1. Probe.
2. Transducer.
3. Linear actuation.
4. Transducer elements.
5. First acquisition.
6. Second acquisition.

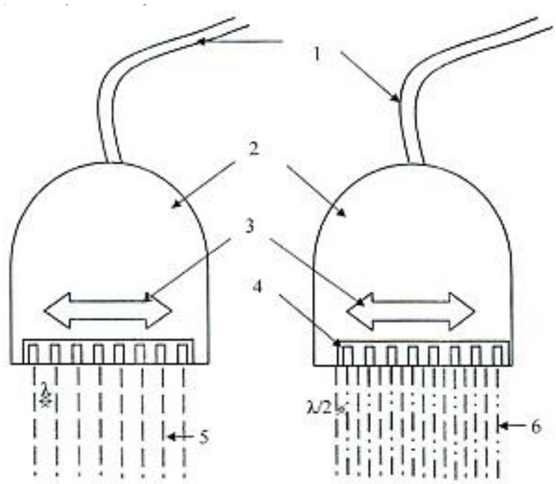

Fig.4 Shows schematic of the **ABT method** used to obtain RFA line data(pre-beam formed or post beamformed) for obtaining sub-pitch resolution

TRL (Technology Readiness Level)

TRL- 4,Technology Validated in the Lab

Research Lab

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