IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO - IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

METHOD AND APPARATUS FOR ULTRASOUND BEAMFORMING USING LIMITED NUMBER OF ACTIVE TRANSDUCER ELEMENTS AND DIVERGING BEAMS

IITM Technology Available for Licensing

Problem Statement

- Current approaches often involve the use of multiple transducer elements during transmission to enhance the depth of penetration and Signal to Noise Ratio (SNR) where these methods typically excite multiple elements simultaneously, **resulting in an unfocused ultrasound beam.**
- Hence, there is **need for imaging techniques with improved frame rate and lateral resolution of images** thereby providing better image quality **without increasing the complexity** and cost of the imaging system

Technology Category/ Market

Category – Biomedical Engineering
Applications –Ultrasound techniques, 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% during the forecast period**

Key Features / Value Proposition

Technical Perspective:

- A novel technique that combines **Diverging Beam with Synthetic Aperture Technique (DB-SAT)**
- **Sampled array (pitch = λ/2)** without increasing system complexity
- The technique of sending diverging waves and using **limited number of active elements not only reduces system complexity and cost,** but also yields high frame rate involving sparse emission

User Perspective:

- **Reduced complexity** in terms of hardware and data handling.
- Dynamic focusing in both transmit and receive, which leads to **better lateral resolution** and it is maintained throughout the depth of imaging.

Intellectual Property

- **IITM IDF Ref. 1469**
- **IN201641032922**
- **PCT/IN2017/050427**

Technology

The invention discloses **a method of ultrasound imaging** comprising the steps :

- ***Exciting a Set of Limited Number of Active Transmit Elements***
- ***Inducing Diverging Waves***
- ***Receiving Backscattered Echoes upon ultrasound***
- ***Translating Electronically the Active Transmit Elements***
- ***Reconstructing the Received Echoes in a Receive Beamformer***
- ***Processing to Form an Image by converting the time-delayed echoes into pixel values***
- ***Displaying the Image***

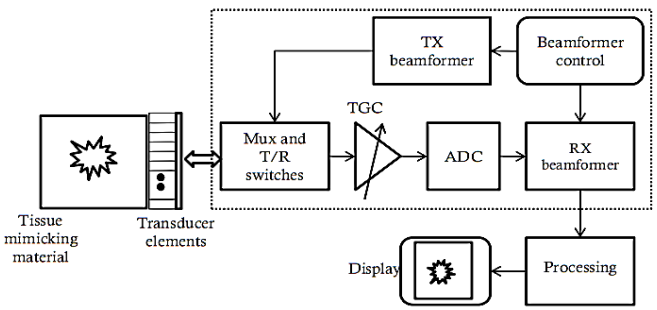

Fig. 1 illustrates a block diagram shows a system for ultrasound imaging comprises of an array of transducer elements

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- The said translating step may have an overlap between two adjacent sets of active transmit elements
- Also, the received echoes data may be from only a partial receive aperture

Further discloses, a system for ultrasound imaging comprising:

- ***Transducer Array***
- ***A Means for Transmit Excitation***
- ***An electronic translating means***
- ***A receive beamformer***
- ***A display device***

- Said array formed may be a single array or two dimensional array.
- The diverging beam synthetic aperture ultrasound beamforming method offers **a less complex ultrasound system by activating only 8 or 16 transducer elements during transmission**

Images

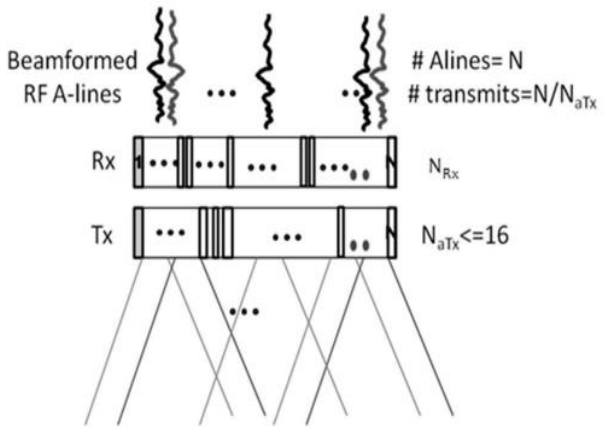

Fig.2 shows an embodiment of the invention proposed with "diverging" beam and full or partial receive aperture.

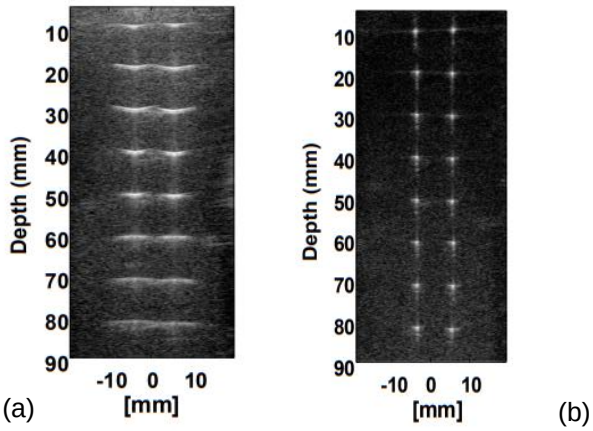

Fig.3(a) shows the experimentally obtained ultrasound image of a medium containing point scatterrers at various positions obtained from the CLA imaging with N_{aTx}= N_{aRx}= 64 elements and number of transmits per image =128 and **Fig.3(b)** with N_{aTx}= 8 and number of transmits per image =16 and after filtering.

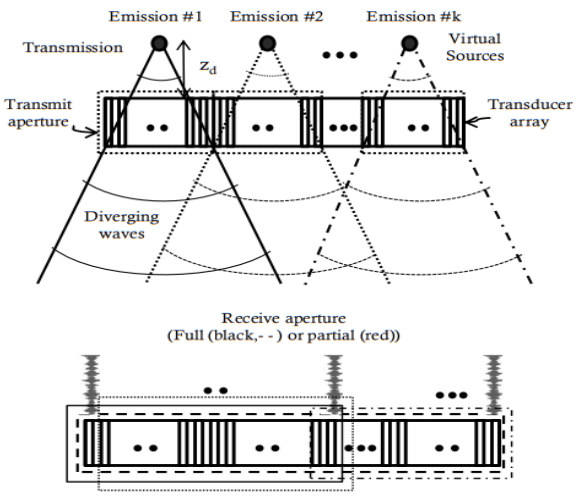

Fig. 4 is a representation of the transmit-receive process continued by electronically continued by electronically translating the active transmit sub-aperture

TRL (Technology Readiness Level)

TRL- 2,Technology Concept formulated

Research Lab

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