SECTION I- BASIC PRINCIPLES OF MEDICAL IMAGING

1. Building blocks of ultrasound imaging.

Ultrasound waves are generated

Alternating voltage is applied

Electrical excitation of piezoelectric crystal

Ultrasound Beam formation

Reflection and attenuation

A mode scanning

Tissue interface

Scanning modes

B mode scanning

Image processor

M mode scanning

Display of image

1. Image processing techniques in classification of optical camera images:

* Image segmentation
* Fuzzy logic
* Markov random field
* Image enhancement

Image enhancement: The components of image are modified for increasing clarity.

Fuzzy logic: Representation of an image into fuzzy sets and the removal of noises.

Markov random field: Method in segmenting an image and process the image constraints such as intensity, texture.

1. Difference between stress and strain in white and grey matter of brain:

When brain tissue is taken for experimental analysis of stress-strain relationship, the result has proved that white matter of brain express unique behaviour for strains lower than 10%.

1. Kramer’s kroenig tissue model:

The relations of conductivity are mathematically expressed by the Kramer’s kroenig model.

1. Diffractive scattering:

Referred and inferring from an article,

When a light wave travels in a path and incident on any obstacle, then waves are subjected to bending and that cause a bright surface in the other bright source.

In case of grey matter, it has been proven that linear elastic theory can be applied on grey matter of brain tissue.

6.

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| --- | --- | --- | --- | --- |
| Modality | Ultrasound | X – ray | Computed tomography | Magnetic resonance |
| What is imaged? | Mechanical properties | Tissue absorption | 3D image of biological tissue | Images of anatomical structures |
| Access | transducers | Cathode interaction with electron | Detector for recording pattern | Magnetic field interaction with protons |
| Spatial resolution | 200 micro metre | < 1mm | 0.5 – 1 mm | 50 – 500 micro metre |
| Temporal resolution | 150 ms | 130-170 ms | 250 ms | 20-50 ms |
| Penetration depth | 1 (low penetration) | 3 | 4 | 5 (high penetration) |
| Safety | 5 (highly safe) | 1 (least safe) | 3 | 4 |
| Cost | 1 (low cost) | 3 | 4 | 5 (high cost) |
| Speed | 100 f/s | 1-2 minutes | 30 s to minute | 10 f/s |
| Portability | 5 (high portability) | 4 | 2 | 1 (low portability) |

7. Linear array ultrasound probe:

Maintains the same angle of view till deep end.

The figure indicates that, linear ultrasound probe covers wide area of organ and maintains the same angle of view till the last end.

Phased array ultrasound probe:

In phased ultrasound probe the viewing angle of organs at the deeper part is more wide than at starting part.

8. Artefacts:

A) Beam width artefact

B) Equipment generated artefact

C) Mirror image artefact

D) Acoustic enhancement