SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Coimbatore-35

DEPARTMENT OF BIOMEDICAL ENGINEERING

23BMT203 - BIOMEDICAL TRANSDUCERS AND SENSORS

UNIT III- MEASUREMENT OF PRESSURE & BLOOD FLOW
II Year/ IV Sem

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ASP / BME / SNSCT

BIOMEDICAL TRANSDUCERS AND SENSORS

Direct Pressure Measurement

- ✓ Catheters type
- ✓ Diaphragm type

Indirect Pressure Measurement

- ✓ Doppler Ultrasound
- ✓ Applanation Method

Blood Flow Measurements

- ✓ Electromagnetic Blood Flow
- ✓ Ultrasonic Blood Flow

Ground Force Measurements

- ✓ Strain gauge type force plate
- ✓ Foot Force Distribution Measurements

Working Principle Ultrasonic Blood Flow Measurements

- Based on the **Doppler Effect**: When ultrasound waves hit moving red blood cells, their frequency changes depending on the speed and direction of flow.

- This **frequency shift** is analyzed to calculate **blood flow velocity**.

- Flow direction, speed, and characteristics (laminar or turbulent) are displayed as waveforms or color images.

Types of Ultrasonic

1. **Continuous-Wave Doppler**
   - Constant transmission and reception
   - Measures high-velocity flow but lacks depth resolution
2. **Pulsed-Wave Doppler**
   - Sends pulses and receives echoes
   - Allows depth-specific measurements
3. **Color Doppler Imaging**
   - Visualizes flow direction and velocity with color mapping
   - Red and blue indicate flow toward and away from the probe
4. **Power Doppler**
   - Detects the intensity of flow (not direction)
   - More sensitive to low-flow states (e.g., in small vessels)

Advantages Ultrasonic Blood Flow

. **Non-invasive and painless**

. Provides **real-time flow information**

. Can assess both **arterial and venous flow**

. Safe for **pregnancy and repeated use**

. Widely available and easy to use

Disadvantages Ultrasonic Blood Flow

- **Operator-dependent** accuracy

- Limited penetration in **obese or deep tissues**

- Cannot measure actual **flow volume**, only velocity

- May struggle with **slow or turbulent flow**

Applications Ultrasonic Blood Flow

- **Carotid artery disease** evaluation

- **Peripheral artery disease (PAD)** diagnosis

- **Fetal and uterine blood flow** monitoring

- **DVT (deep vein thrombosis)** detection

- **Cardiac valve and chamber flow** assessment

- **Organ perfusion** in kidneys, liver, etc.