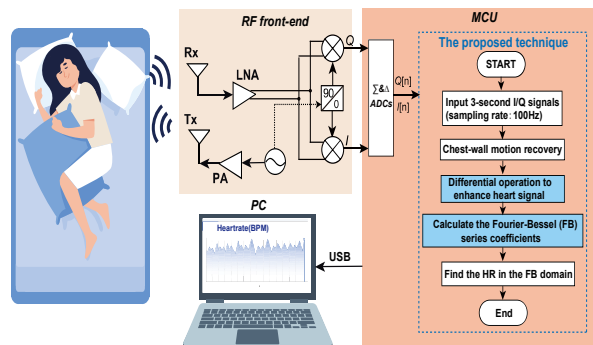


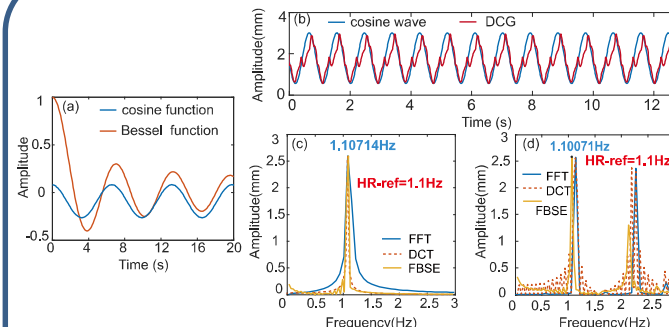
Sleep Monitoring

- ✓ Continuous fast heart rate (HR) detection: accurate short-time (less than 5s) HR estimation
- ✓ Sleep staging indicator validation: clinical validation through over-night experiment
- ✓ Portable contactless sensor design

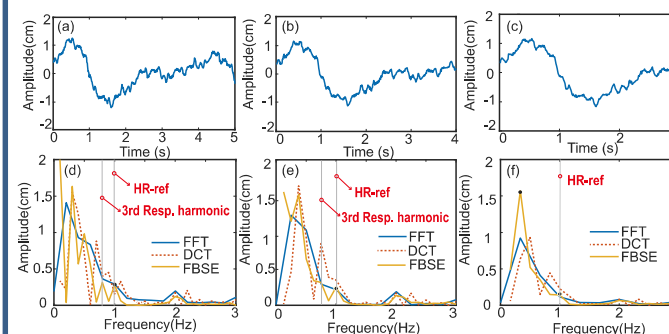


Sleep monitor system using proposed technique with Doppler radar:

- ✓ High-linearity Doppler radar sensor design
- ✓ Fourier Bessel series expansion (FBSE)-based fast HR estimation
- ✓ Sleep staging indicator calculation and clinical validation

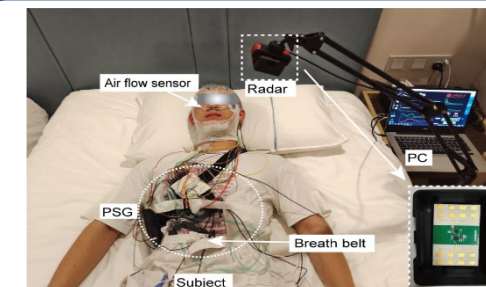


The basis functions in DCT, FFT and FBSE and comparison of the spectrum representation in different heart motion simulation.

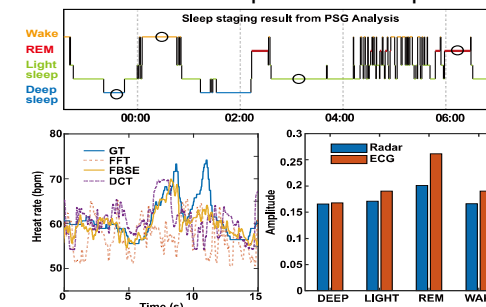


Simulated chest-wall motion signals in time domain with different window length:

- ✓ FBSE-based technique has the best estimation performance
- ✓ Capacity of less than 5 seconds time window HR estimation



Clinical experiment setup



Sleep staging indicator calculation with respect to the PSG staging results

Doppler Radar System in sleep staging:

- ✓ Portable, comfortable, accurate
- ✓ Accurate fast HR detection with FBSE technique
- ✓ Capacity of HRV detection enabling accurate sleep staging