

Random body movement (RBM) is one of the most challenging issues in non-contact vital sign detection using Doppler radar technique. The large and irregular displacement of the human body could corrupt the vital sign signal and significantly degrade the accuracy of detection. Even the respiration rate (RR) sometimes cannot be measured accurately under RBM. In this paper, the characteristic of the frequency spectrum of the vital sign signal under body motion (the motion modulation effect) is analyzed. Based on that effect, an RR measurement method under one-dimensional (1-D) body motion is developed using only one non-contact continuous-wave (CW) Doppler radar vital sign detection system. The direction of body motion is extracted along with the new position of the respiration peaks in the frequency spectrum and RR can be calculated. Simulations of the theory using a model of the vital sign detection system are performed, followed by experiments to verify the theory. Experiments are performed on an actuator and a human subject by only one 5.8-GHz non-contact CW vital sign detection system. Under large 1-D body motion that has a displacement 5-10 times larger than the respiratory displacement, the proposed method successfully measures RR with only 7.15% error.