Abstract

The following experimental design and setup have been created by the author and supervisor. Current methodologies for non-invasive blood pressure measurement are flawed due to the subjective nature of measurement. Experimentation has been performed to determine to what degree relevant cardiovascular metrics can be non-invasively extracted from idealised software and hardware models of a human upper limb. The physical model is constructed to replicate the dimensions of major arteries and veins of the upper limb and is filled with water to approximate the vessels in the upper arm. Static water tests are performed to calibrate the model in order to obtain appropriate parameter values. Pulse and collect experiments have been performed on volumes of water flowing through cardiovascular analogues that are polarised upstream by 300 mT annular Halbach arrays. Testing is performed using the *TerraNova-MRI* Earth's Field Nuclear Magnetic Resonance apparatus from *Magritek*. Signal models obtained from literature have been modified to determine the effect of vessel compliance on flow measurements. A direct positive correlation ($p = 0.88$) between signal level received and the increasing pressure and volume of water within the model is observed. The average standard error between measurements is 0.04 μV, or 10% of the magnitude of the smallest measured signal. The relative error between theoretical and measured signals is 30%. The relative error is unreliable as the theoretical model does not include the effects of noise. The compliance of the model's vessel analogues is estimated to be 1.48 ml/mmHg compared to normal healthy young human compliance values of ~ 2 ml/mmHg. An empirical relationship between the pressure and signal captured by the apparatus is found. The problem is ill-posed with many possible pressure-volume relationships able to output the same signal result. Calibration of the signal and model needs to be performed to determine a direct causal relationship between blood pressure and the EFNMR signal captured.