

معهد الإرادة للتعليم العالن والمتوسط والأساسن

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The Scientific Will Journal is concerned with human and applied studies

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شروط النشر

- -1 يجب أن يكون البحث المقترح للنشر أصيلا لم يسبق تقديمه لمجلة أو أي جهة ناشرة أو أكاديمية، وأن لا يكون جزءا من رسالة عليمة.
- 2- لا يقل البحث الواحد عن 20 صفحة، ولا يزيد على 30 صفحة حتى تتاح فرصة النشر لأكبر عدد من الباحثين.
 - 3- ترسل البحوث إلى المجلة مطبوعة على الحاسوب باستعمال Word باللغة العربية:
- الخط المستخدم في المتن Simplified Arabic الحجم 14 أما الهوامش فتكون آلية أسفل كل صفحة على حدة؛ بنفس الخط حجم 12.
 - 4- بالنسبة للبحوث المحررة باللغة الإنجليزية:
- الخط المستخدم في المتن Timed New Roman الحجم 12، أما الحواشي فتكون بنفس الخط بحجم 10
- 5- أن يكون توثيق الكتب بذكر شهرة المؤلف متبوعا باسمه الأول والثاني واسم الكتاب، واسم الكتاب، واسم الكتاب، والمجلد.
- -6 أن يكون توثيق الدورية بذكر اسم كاتب المقال، عنوان البحث موضوعا بين علامتي تنصيص " " ، واسم الدورية، ورقم المجلد والعدد والسنة، ورقم الصفحة.
- 7- يلتزم الباحث القيام بالتصويبات والتعديلات التي اقترحها المحكمون خلال شهر من تاريخ تسلمها.
 - 8- الأبحاث المنشورة لا تعبر إلا عن رأي أصحابها.
 - 9- يخضع ترتيب الأبحاث في المجلة لمعايير فنية.
- 10- يكتب الباحث في الصفحة الأولى من البحث إسمه وعنوانه الكامل بالهاتف والإيميل والمؤسسة التي ينتمي إليها، وكذلك الدولة، باللغة العربية والإنجليزية. (ويفضل أن يكون اسم الباحث ثلاثيا).
 - 11 عنوان البحث باللغة العربية والإنجليزية،
- 12- يكتب ملخصا باللغة العربية وآخر باللغة الإنجليزية بما لا يزيد عن 100 كلمة لكل منهما، وكذلك الكلمات المفتاحية باللغتين العربية والإنجليزية.
- 13- مجلة الإرادة العلمية محكمة، وهي ترحب بجميع المقالات المستوفية للشروط السالفة الذكر، ولا ترد المقالات لأصحابها في حال عدم نشرها.

POWER SPECTRUM AND AUTO-CORRELATION OF THE HEART SIGNALS DURING BLOOD PRESSURE MEASURMENTS SIMULTANEOUSLY

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الملخص

يعتبر القلب من الاعضاء الرئيسية لاستمرار حياة الإنسان, وهو عبارة عن مضخة ترددية نتيجة انقباض وانبساط عضلات القلب. المراقبة والعناية بالقلب أمرا ضروري لتجنب أي مخاطر قد تحدث له. في هذه الورقة تم قياس معدل اشارة تدبدب تدفق النبض داخل الشرايين (HRS) باستخدام مجس (DFrobot) متصل مع منظومة تجميع بيانات متطورة. وقد تم أيضا قياس ضغط الدم الانقباضي والانبساطي باستخدام جهاز معاير من نوع (ALLHeart) أنيا مع (DFrobot). ثقنية البيانات المستخدمة في هذه الورقة عالية الدقة تصل قرائتها الي 1.25 Ms/sec, حيث ثم تحليل الاشارة المقاسة باستخدام LabVIEW. في هذه الدراسة تم تحليل البيانات المقاس لشخصين, الاول يبلغ من العمر 20 عاما مقابل الاخر يبلغ من العمر 60 عاما وذلك لغرض المقارنة بينهما من خلال التحليل الطيفي (power spectrum) و معامل الارتباط (Auto-correlation) . أظهرت النتائج بدقة معرفة التردد المهيمن لكل مرحلة من مراحل القياس (HRS) المختلفة قبل وأثناء وما بعد قياس ضغطى الدم الانقباضي وألانبساطي والذي مبين في كل مراحل القياس من خلال التحليل الطيفي الإشارة التي منها تم حساب عدد نبضات القلب في الدقيقة. وكذلك مدى الاختلاف بين السعة والشكل للنبضات من خلال حساب معامل الارتباط للإشارة المقاسة لـ HRS. على الرغم من أن الشخص المسن يعانى من ضغط الدم الغير طبيعي إلا أن نتائج هذه الدراسة أظهرت أن معامل الارتباط لـ HRS للشخص المسن أقوى بكثير مما هو عليه في الشخص الأصغر سناً. والجدير بالذكر أن

هذه المعلومات القيمة التي تم الحصول عليها تهتم بسلوك النبضى للقلب, والتي من الممكن أن تساعد الاطباء المختصين في تشخيص مشاكل الدورة الدموية للإنسان وأهمها القلب.

ABSTRACT

The continuation of human life relies on the heart and it's reciprocating blood pump utilizing a systolic and diastolic system. To avoid any risks, monitoring and taking care of the heart is essential. In this study, heart rate signal (HRS) is measured using a DFrobot HR Sensor and a AllHeart stethoscope/device to read the systolic and diastolic blood pressure simultaneously. The HRS data was collected using a data acquisition card at a sampling rate of 1.25 Ms/s and processed through a software called LabVIEW. This investigation was conducted on two people (20 year old male vs 60 year old male) to compare HRS in terms of power spectrum and auto-correlation. In the power spectrum, the dominant frequency of the HRS is known at any stage during the measurement in which the dominant peak frequencies are marked at each stage of the signal. We used this to derive the number of heart beats per minute (pulse). The auto-correlation of the elderly person illustrates that HRS is much stronger than in the younger person, causing a difference in the shape of the amplitude between pulses even though the elderly person has abnormal blood pressure. These valuable data sets obtained helps specialists and doctors in diagnosing the heart more accurately.

KEYWORDS: Heart Rate Signal; Systolic and Diastolic Blood Pressure; Power Spectrum, Auto-correlation; Dominant Frequency

INTRODUCTION

It has become a necessity to contribute to all applied sciences to improve the level of scientific development and to find solutions to problems encountered by many fields. The strong correlation between modern and advanced medical science is heavily based on technical science such as applied mechanical engineering. To create such solutions, cooperation between fields of study has become vital. One of the main contributing factors to the diagnosis and successful micro-operations is due to the intervention of mechanical engineering technology. This research article uses instruments to measure the velocity of blood flow inside arteries and veins. Based on these measurements, the time history of each heartbeat is then analyzed.

Pulse is the rhythmic dilation and expansion of an artery caused by the opening and closing of the aortic valves in the heart. Heart Rate Variability (HRV) refers to the variation between a normal heart rate and a given mean value. HRV is the degree of interesting and useful information for the user.

fluctuation in the time interval between heart beats. HRV's level changes naturally from day to day; it's reliant on the level of physical activity and the amount of workrelated stress. These issues aforementioned results in a strained body which can cause various mental and physical health problems. Wearable devices, for the ear and wrist, mostly use photoplethysmography (PPG) to detect the heartbeat optically. It does so by measuring the wave of blood flow and thus calculates the interbeat interval (IBI). Comparing the data between different methods is always challenging, however, if

Various applications of Heart Rate Variability (HRV), different linear (for what), frequency and wavelength domains, nonlinear techniques that are used for the analysis of the HRV were reviewed and discussed by ChuDuc at el (2013) [1]

different methods and devices are used correctly and systematically, it can produce

Among research journals, the most commonly used technique for HRV is Spectral analysis. In this linear method, spectral power in a high frequency band is employed to reflect respiratory sinus arrhythmias while a low frequency reflects baroreceptor control. Extremely low frequency power shows the vascular and thermoregulatory functions of the heart [2].

Schroeder et al. (2008) [3] showed that HRV specifically measures nonlinear dynamics and clinical parameters. They both contribute to an enhanced risk stratification in a patient's heart failure which is independent from the origin of heart failure that has to be verified by additional studies.

Traditional time and frequency domain heart rate variability (HRV) have the patient's cardiac at risk of mortality post-myocardial infarction. Recently, non-linear HRV has been applied to risk stratification of patient's cardiac, Stein et al (2005) [4] revised the studies of non linear HRV and outcomes in the patient's heart muscles. These studies were used the three most common non-linear indices: Power Law Slope, the short term Fractal Scaling Exponent, and measures based on Poincare Plots. The studies concluded that a combination of traditional and non-linear HRV may be (or is) optimum for risk stratification as well as being used in a clinical settings.

Albatrookh et. al (2017) [5] described the methods of SI models that fit the system structures to measure the input and output data well as the basic characteristics of the resulting models of evaluation. Experiments conducted using different types of SI models on real-world heart signal.

In this paper, a high-speed advanced data collection card is used to measure the velocity of blood flow within the arteries and veins, which can be used to measure heart rate signal (HRS) at different stages. It also measures systolic and diastolic blood pressure simultaneously at a data acquisition card speed of up to 1.25 Ms/sec. The time series of HRS of a 20 year old and 60 year old will measure of blood flow fluctuated, within the arteries, the signal time series used to calculate the power spectrum and auto-correlation for all stages.

EXPERIMENTAL APPARATUS AND SETUP

The experimental rig that is conducted in this study shown schematically in Figure 1. Basically, it consists of a heart rate monitor Sensor system and data collection system. The DFRobot heart rate sensor is a thumb-sized heart rate monitor designed for Arduino micro-controllers. The heart rate monitor sensor is a pulse sensor which is developed based on Photo Plethysmo Graphy (PPG) techniques,

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The blood volume changing in the micro vascular bed of tissues and the pulsate component of the cardiac cycle are relatively simple to detect.

The input voltage (Vin): 3.3 - 6V (5V recommended), Operating current: <10mA and its dimension: 28 x 24[mm]. A data acquisition card mounted in a PC were used to acquire the Heart Rate Signal (HRS) data. LabVIEW (National Instruments) software as well as the data acquisition card NI(PCI-MIO-16E-1), with 8 input were used. Table 1 displays the data acquisition card differential channels specifications. Additionally, shielded I/O connector block (SCB-68) is used for interfacing I/O signals.

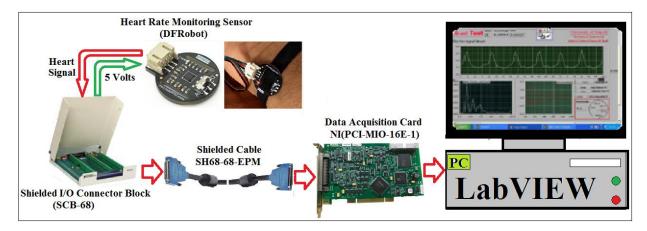


Figure 1. Overall experimental setup of the Heart Rate Signal (HRS) apparatus.

Table 1. data acquisition card specifications NI(PCI-MIO-16E-1)

de 1. data acquisition card specifications N1(PC1-M1O-16E-1)					
A/D channels input	16 Single-Ended / 8 Differential				
A/D resolution input	12 bits				
Maximum sampling rate of A/D input	1.25 Ms/sec				
Bipolar input ranges	±10 volts				
Uni-polar input range	10 volts				
D GND terminals supply voltage power source	+5 V				
D/A channels output	2				
D/A resolution output	12 bits				
Maximum sampling rate of D/A output	1 Ms/sec				
Application software support	LabVIEW and MATLAB				

All Heart standard blood pressure cuff with a maximum pressure of 300 mmHg have been used to measure systolic and diastolic blood pressures synchronized with the measurements of heart rate signal (HRS). As shown in Fig. 2. The calibrated Bourdon tube pressure gauge with a range of 20 to 300 mmHg (gage pressure. The pressure gage communicates with a compression cuff through a rubber tube. When air pressure is acts on the inner walls of the bourdon tube, by pumping the pressure bulb, the bourdon tube tends to change in cross – section from elliptical to circular. This tends to straighten the bourdon tube causing a displacement of the free end of the bourdon tube, and indicates how much pressure the cuff is applying against the artery.



Figure 2. AllHeart standard blood pressure cuff.

Correlation and Power Spectrum Concepts

The correlation of the heart rate signal (HRS) values at two instants of time is described by the autocorrelation function:

$$\mathfrak{R}_{HRS}(\tau) = \lim_{T \to \infty} \frac{1}{T} \int_{-T/2}^{T/2} HRS(t) \ HRS(t+\tau) \ dt$$

Where the time difference τ , is usually called delay or lag. The autocorrelation function can be determined from a single sample signal.

The function is even and it has its maximum value at $\tau=0$. With increasing τ , the function usually decreases towards the square of its mean value (the covariance function decreases towards zero). This may take place with damped oscillations. The autocorrelation function approaches zero at great lag values. The idea of autocorrelation function is to compare signal values at different instants of time, a positive \Re_{HRS} means that the signal values have often the same sign, and a negative \Re_{HRS} means that opposite signs are usually expected. If $\Re_{HRS}=0$, the relation of the signs is unpredictable. In addition to signs, the absolute values of the signals also contribute to the autocorrelation function. This implies that a knowledge of the autocorrelation function, obtained from a measured signal, allows predictions to be made of the signal behaviour. The uncertainty of this prediction grows with time distance.

The autocorrelation function of the random process is directly related to its frequency measurement by the Fourier integral relationship given by (Dowling and Williams, 1983, Nelson and Elliott 1992) [6,7]

Williams, 1983, Nelson and Elliott 1992) [6,7]
$$\widehat{\Re}_{HRS}(\omega) = \int_{-\infty}^{\infty} \Re_{HRS}(\tau) e^{-i\omega t} dt = 2 \int_{-\infty}^{\infty} \Re_{HRS}(\tau) \cos(\omega \tau) d\tau \qquad \qquad 2$$

where, $\widehat{\Re}_{HRS}(\omega)$ is the Fourier transform of autocorrelation function $\Re_{HRS}(\tau)$. This relationship is known as the power spectrum of the signal.

The heart is the main component of the human blood circulation, which acts as a reciprocating blood pump, resulting in a pulse of blood inside the arteries, causing it to expand and contract, which can be felt when pressing the finger in different pulse pressure areas of the human body, and also can be heard through a stethoscope. In this study, the sensor was placed inside the arm in the elbow after a AllHeart standard blood pressure cuff mounted on the human arm, to obtain the pulse and blood pressure measurements. Pulse and blood pressure were measured using advanced data collection technology from National Instruments, in this test of measurements of the heart rate signal (HRS) during systolic and diastolic blood pressure measurements are analyzed. The number of samples (N.S) was 1200, and sampling rate (S.R) was 20 samples per second, with duration time (t) of 60 seconds.

The data were collected analyzed by using LabVIEW software in terms of autocorrelation and power spectrum. In addition, the number of heart pulses per minute and rms values of the heart blood signals were calculated. Data analysis will take place in two categories. The first category is a single process analysis and the second one is a shear stress analysis:

RESULTS AND DISCUSSIONS

1- Signal Process Analysis

In this research, the study will analyze from the point of view of the engineering of fluid mechanics to measure the pulse caused by the speed of blood flow (Newtonian fluid) within the arteries before measuring systolic and diastolic blood pressure (normal condition), during measurement of systolic and diastolic blood pressure, and after measurement of systolic and diastolic blood pressure (return to the normal condition). To further understand, the age effect on systolic and diastolic blood pressure have been studied, a full mapping of the heart rate signal (HRS) measurements field has been carried out, and a comparison between two persons have been done for 20 and 60 years persons.

Figure 3, shows the heart rate signal (HRS) as function of time during all stages including the systolic and diastolic blood pressure measurements for both ages. the signal of HRS is divided into a number of measurement stages, beginning with the first stage before measuring blood pressure, at state of complete relaxation, in a time of about 10 to 15 seconds, i.e. normal case. Followed by the second stage, at which point the blood pressure measurement process begins, where it begins to raise the pressure of the cuff that installed on the human arm using a hand pump, the role of the hand pump of the cuff is to create pressure in the system used to measure blood pressure, specifically, to press on the arteries. It should be held in the right hand, with a pressure control valve on the left side (inside). The pressure control valve controls the system discharge rate. To close the valve, or inflate the cuff, the valve is turned on with the thumb towards you. To open the valve, or empty the cuff, the valve must be turned on with the thumb away from you. Learning to use a thumb valve is an important part to measure blood pressure. The pressure of the device is raised slightly

higher than the systolic pressure by about 30 to 40 mmHg. In normal condition of humans, systolic pressure is known to reach about 120 mmHg. When the pressure of cuff is higher than the systolic pressure no blood flowing inside the arteries, in which case the heart rate sensor stops reading, because there is no blood pulse inside the arteries, that will record a random signal.

In the third stage, when the cuff reached the maximum pressure, the control valve is gradually opened until the first pulse is recorded by stethoscope. at the time of hearing the first pulse, the pressure gauge must be immediately recorded or at the first pulse in the time history of the HRS chart after no blood flowing signal(see Figure 3). This pressure is called the systolic pressure of the person. By continued opening the control valve gradually, the cuff pressure decreases until the pulse cannot be heard, at this moment, the pressure of the cuff must be recorded immediately which is called diastolic pressure of the person.

In the last stage of this measurement, the recorded signal returns to the normal state. Each of these stages will be analyzed in detail in subsequent results.

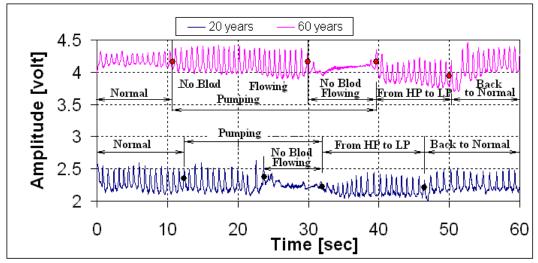


Figure 3. signals time history of the heart rate signal during systolic and diastolic blood pressure measurements

Figure 4 shows the time history of different stages, for two cases. **The first stage** of the Heart Rate Signal (HRS) was obtained before starting blood pressure measurements. In this stage the number of pulses are 75 pulse/ min for 20 years old and 80 pulse/min for 60 years old. The root mean square (RMS) of the signals are 0.125 volt for 20 years and 0.074Volt for 60 years, as shown in the Table 2. Also, this table indicated that the young person had higher signal fluctuation than old person.

In the second stage, the systolic and diastolic blood pressures are started to measure in the pumping stage. For instant, for the age of 20 years the pumping started at time 12 seconds and ended around 32 seconds, while for the age of 60 years the pumping started around time 11 seconds and ended around 40 seconds. Delays in pumping for 60 years old person due to the high systolic pressure (abnormal blood pressure).

During pumping stage, it can be seen that the number of heart pulses are 72.5/ min for young person and 82.8/ min for elderly person and the RMS voltage of the heart

signal are 0.1147 for young person and 0.140 f or old person. At a certain pumping pressure in the cuff, the signal is disappear, that means no heart pulses, in this stage of measurements the HRS considered to be a random signal.

by continues pumping process using the a rubber bulb to about 30 to 40 mmHg above. the HRS signal disappeared.

In the third stage of blood pressure measurement is to determine systolic and diastolic pressure of humans, the systolic pressure of the young person was 116 mmHg, which is a normal systolic pressure for humans, and for elderly person was 141 mmHg, which is abnormal systolic pressure. The RMS voltage of the heart signal are 0.08789 for young person and 0.139 for old person while the diastolic pressure was 67 mmHg for young person (normal diastolic pressure), and for the elderly was 95 mmHg that is in the range of abnormal diastolic pressure.

In the last post-blood pressure measurement stage, the HRS heart rate chart was to normal condition. the RMS voltage of the heart signal are 0.0971 for young person and 0.161 for old person. Also, from the power spectrum of this stage, the dominate frequencies were 1.08Hz for young person and 1.35Hz for old person. This value corresponding to 65 beats/min 81 and beats/min respectively.

Table 2. compression results values of two different ages.

20 years				60 years				
	Mean	RMS	f [Hz]	Pulse/min	Mean	RMS	f [Hz]	Pulse/min
Stage 1	2.272	0.125	1.26	75.6	4.170	0.074	1.33	80.38
Stage 2	2.239	0.1147	1.20	72.5	4.105	0.140	1.38	82.84
Stage 3	2.160	0.08789	1.190	71.419	3.944	0.139	1.311	78.692
Stage 4	2.229	0.0971	1.08	65.1	4.088	0.161	1.35	81.36
Systolic blood pressure [mmHg]			116 143					
Diastolic blood pressure [mmHg]			67	95				

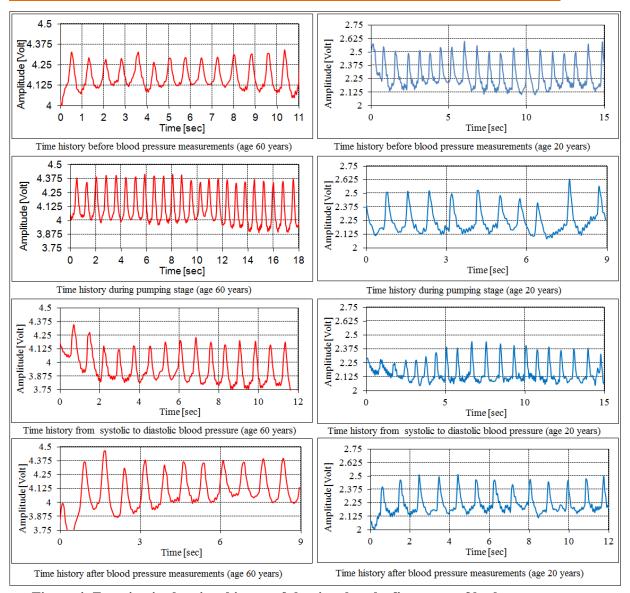


Figure 4. Zooming in the time history of the signal at the first stage of both ages. Based on the time series of the signals and equation 2 the power spectrums have been calculated. Figure 5. shows the power spectrums of all stages for both persons. Each subfigure is marked the peak frequencies of the HRS signal. A sub harmonic frequency is also present for all HRS signal. Figure 6 illustrates a family of autocorrelation curves of the HRS signals for four stages.

The auto-correlation curves of the age 60 years HRS signals kept similar for all stages while they had a very strong correlation signal. However, the auto-correlation are a little bit weak during the blood pressure measurement for young person. it's essential to identify that the auto-correlation curves did not descend to zero, thus the signal had strong correlation for all stages.

From the results, the power spectrum and auto-correlation of the blood flow signal the blood flow fluctuation (RMS) of the young person is more turbulent than the elderly person. This situation accrued before the blood pressure measurement. On the other

hand for the last stage of measurement, the opposite RMS results occurred the blood flow fluctuation was more turbulent for the elderly person.

Power spectral analysis of HRS signals also assures that the power spectrum chart of the elderly person is more regular at all stages, whereby the dominant frequency at all stages marked on each sub figure (pre-blood pressure 1.33Hz, during pumping process 1.38Hz, systolic and diastolic pressure 1.31Hz, and after blood pressure measurement 1.35Hz) that corresponding to the number of pulses of the heart which were 80, 82, 78, and 81 beats / minute respectively.

Even though systolic and diastolic pressure is abnormal for an elderly person, the analysis of the HRS heart chart signal indicates that the signals is more stable compared to a young person. This comparison between signals is very clear by zooming - in the time series of both ages as shown in Figure 7. The heart pulses of elderly person almost the same in their shape and amplitude, but for the young person, there are some different in their shape and amplitude.

The power spectrum charts of the elderly person shows peaks of small amplitude frequencies, which is called sub-harmonics thus these sub-harmonics are visible in ratio of 1:2:3:....... For example, the sub-harmonics of the power spectrum analysis of the signal before the blood pressure measurement before the blood pressure measurement process, the sub-harmonics were 1.3Hz, 2.6Hz, and 3.9Hz while in a young person these sub-harmonics were unclear due to irregular HRS pulses of the heart.

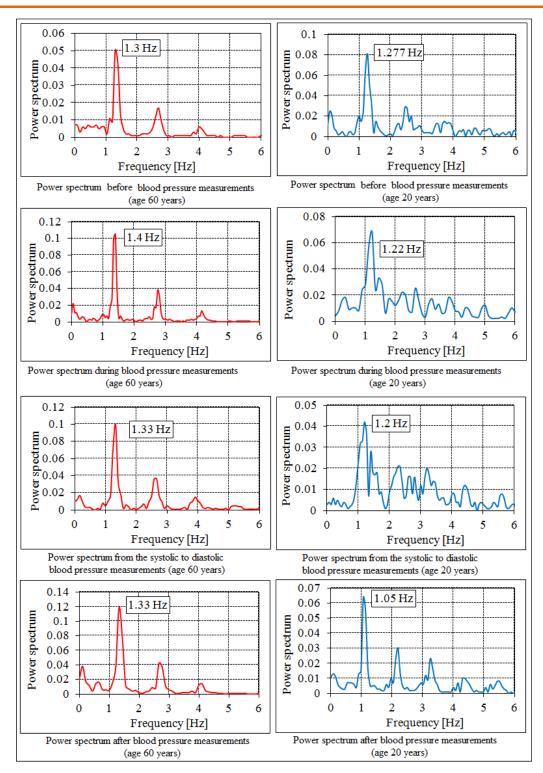


Figure 5. Power spectra of four simultaneously measured signals of HRS.

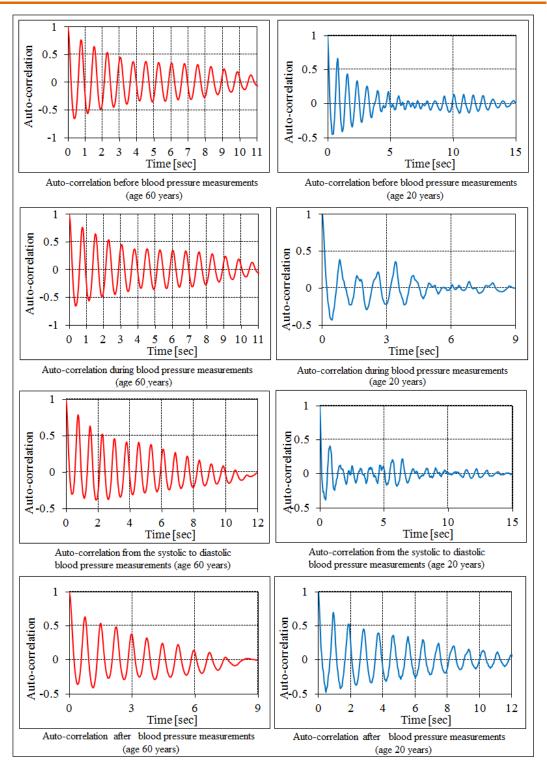


Figure 6.Auto-correlation of all stages at different ages during blood pressure measurements.

2. Shear Stress Analysis

It is known that blood flow within the arteries depends on several factors. The first factor is the strength of pumping blood from the heart. This factor depends on the heart condition of the human in terms of age as well as heart disease. The second

factor is fatty deposits on the inner surface of the arteries, which cause a decrease in the area of blood flow through the arteries, resulting in increase of shear stress. Also the percentage of blood fat, cholesterol, has a significant effect in increasing the viscosity of the blood, which is resist to flow inside the arteries, that will effects on systolic and diastolic blood pressure. All these items are the fluid mechanics engineering factors.

The difference voltage between the top and bottom of the pulse as shown in Figure 7. This graph indicated that the speed of blood flow within the arteries had a maximum value at the top of the pulse due to systolic pressure from the heart. However. The speed of blood inside the arteries, in case of hypotension from the heart, had the minimum value. The difference values between these speeds is very important for the stability of blood circulation within the arteries and veins. By assuming the blood is a Newtonian fluid, the fluid

can be undergoes to the following equation:

$$\tau = \mu \, \frac{dV}{dr} \tag{3}$$

where:

 τ is the shear stress.

μ is the dynamic viscousity of the blood.

V is the blood velocity.

r is the raduis of the arteries.

From the equation, and the point of view of fluid mechanics, it is clear that the shear stress has highest value at the maximum speed of blood, i.e. shear stress is a maximum at the top of the pulse, and minimum value at the bottom of the pulse. It is well known that the arteries have a properties of flexibility which gives them the ability of contract and expand at each heartbeat. When the difference in voltage between the top and bottom of the pulse is large, the greater the extent of constriction of the arteries and veins, and over time the arteries and veins are exposed to severe fatigue strain, and may be the cause of the Varicose veins disease. In addition, the dynamic viscosity of the blood has a direct effect on shear stress, at high dynamic viscosity of blood that will produce strong shear stress due to the fatty blood (high cholesterol). Also the diameter of the arteries and veins has the inverse proportional on shear stress, less shear stress in the small diameter of arteries and veins.

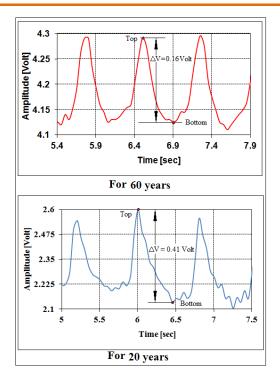


Figure 7. Zooming in the time history of the signal at the first stage of both ages.

CONCLUSIONS

The combination of using simultaneously DFRobot heart rate sensor based on Photo Plethysmo Graphy (PPG) and AllHeart standard blood pressure cuff device techniques. Measurement of the Heart Rate Signal (HRS), and systolic and diastolic blood pressure respectively are very useful in gathering important information about the correlations and heart rate signal monitoring. The results indicated that that the human systolic and diastolic pressure is abnormal but the heartbeats are stable such as in the case of elderly person. and vice versa as in the case performed of a young person, where his systolic and diastolic pressure was normal while the heartbeats are unstable.

NOMENCLATURE

$\Re_{\mathrm{HRS}}(\tau)$	Auto-correlation	RMS	Root Mean Square
$\widehat{\mathfrak{R}}_{HRS}(\omega)$	Power spectrum	τ	shear stress
HRS	Heart Rate Signal	M	dynamic viscousity
N.S	Number of Samples	V	blood velocity
S.R	Sampling Rate	r	raduis of the arteries

REFERANCES

- [1] Hoang ChuDuc, Kien NguyenPhan, Dung NguyenViet (2013)." A Review of Heart Rate Variability and its Applications" International Journal of Science and Research (IJSR) Science Direct, pp 80-85
- [2] Gang Yi, MD, PhD, and Marek Malik, PhD, MD, FACC, FESC (2003) "Heart Rate Variability Analysis in General Medicine" Indian Pacing and Electrophysiology Journal, 3(1): 34-40
- [3] Voss1A, Schroeder R, Vallverdu M, Cygankiewicz I, Vazquez R, Bayes A de Luna, P Caminal (2008), "Linear and nonlinear heart rate variability risk stratification in heart failure Patients" Conference Paper, Computers in Cardiology 2008;35:557-560.
- [4] Phyllis K. Stein, Ph.D., Anand Reddy, M.D. (2005) "Non-linear heart rate variability and risk stratification in cardiovascular disease" Indian Pacing and Electrophysiology Journal, 5(3): 210-220
- [5] Ismail M. Albatrookh, Ahmed A. Baaiu, Mustafa A. Elsherif and Almabrok Essa (2017) "Heart Signal Acquisition Based System Autoregressive Identification Models" The international Journal of Engineering and Information Technology, Vol.4, no.1, pp. 80-85
- [6] Dowling, A. P. and Williams, J. E. (1983). "Sound and Sources of Sound," llishorwood UK.
- [7] Nelson, P. A. and Elliott S. J. (1992). "Active Control of Sound," *Institute of* sound and viberation research, Southampton, UK.