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DHAKA, BANGLADHESH

ORGANIZATION OF ISLAMIC COOPERATION

ANALYSIS OF MUSCLES AND GRIPPING ACTIVITIES OF HUMAN HAND DURING DRILLING OPERATION

A thesis submitted to the department of Mechanical and chemical Engineering (MCE), Islamic University of Technology (IUT), in the partial fulfillment of the requirement for degree of Bachlor of Science in Mechanical Egineering.

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CERTIFICATE OF RESEARCH

The thesis title **"ANALYSIS OF MUSCLES AND GRIPPING ACTIVITIES OF HUMAN HAND DURING DRILLING OPERATION"** submitted by Taimur Hassan khan (Student no: 101448) and Mohammed H Alaqad (Student no: 101450) has been accepted as satisfactory in partial fulfillment of the requirement for the Degree of B.Sc in Mechanical and Chemical Engineering on june, 2014.

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DECLARATION

It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

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We seek excuse for any errors that might occur in this report despite of our best efforts.

ABSTRACT

Drilling is the most common machining process. One estimate is that 75% of all material removed comes drilling operations. Drilling involves the creation of holes that are right circular cylinders. This is accomplished most typically by using a twist drill, something most readers will have seen before. The figure below illustrates a cross section of a hole being cut by a common twist drill. Many vibration exposed workers have been found to suffer from muscle fatigue and decreased grip strength. Therefore in order to quantify and determine safe levels of human exposure to vibration, measurements and analysis of significance vibration factors are necessary. There are three main objectives in this study.

During the planning and preparation of this report the authors had the advice of some people engineers, library assistants.

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PART 1

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION OF DRILL

A drill is a tool fitted with a cutting tool attachment or driving tool attachment, usually a drill bit or driver bit, used for boring holes in various materials or fastening various materials together with the use of fasteners. The attachment is gripped by a chuck at one end of the drill and rotated while pressed against the target material. The tip, and sometimes edges, of the cutting tool does the work of cutting into the target material. This may be slicing off thin shavings (twist drills or auger bits), grinding off small particles (oil drilling), crushing and removing pieces of the work piece (SDS masonry drill), countersinking, counter boring, or other operations.

Drills are commonly used in woodworking, metalworking, construction and do-it-yourself projects. Specially designed drills are also used in medicine, space missions and other applications. Drills are available with a wide variety of performance characteristics, such as power and capacity .

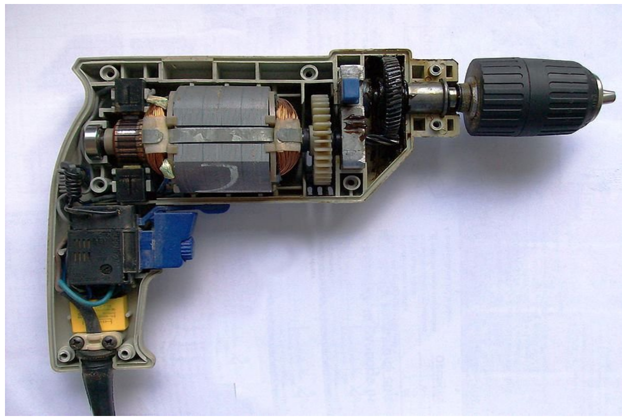


Fig 1.1: hand drilling machine

The speed of a drill is usually measured in terms of the rate at which the outside or periphery of the tool moves in relation to the work being drilled. The common term for this velocity is "surface feet per minute", abbreviated as sfm. Every tool manufacturer has a recommended table of sfm values for their tools. General sfm guidelines are commonly found in resources such as the Machinery Handbook (see Table 1 in this document).

The peripheral and rotational velocities of the tool are related as shown in the following equation:

$$V = \pi * D * N \text{ (Eq. 1)}$$

Where

V is the recommended peripheral velocity for the tool being used

D is the diameter of the tool

N is the rotational velocity of the tool

Since the peripheral velocity is commonly expressed in units of feet/min and tool diameter is typically measured in units of inches, Equation 1 can be solved for the spindle or tool velocity, *N* in the following manner

$$N\ [rpm] = 12\ [in/ft] * V\ [sfm] / (\pi * D\ [in/rev]) \text{ (Eq. 2)}$$

1.2 TYPES OF DRILLING MACHINE

- Hand tools
- Pistol-grip (corded) drill
- 2.3 Hammer drill
- Rotary hammer drill
- Cordless drills
- Drill press
- Geared head drill press
- Radial arm drill press
- Mill drill
- Accessories

Hand tools

A variety of hand-powered drills have been employed over the centuries. Here are a few, starting with approximately the oldest:

- Bow drill
- Brace and bit
- Gimlet
- Hand drill, also known as an "eggbeater" drill
- Breast drill, similar to an "eggbeater" drill, it has a flat chest piece instead of a handle
- Push drill, a tool using a spiral ratchet mechanism
- Pin chuck, a small hand-held jeweler's drill

Fig 1-4

Pistol grip (corder) drill

Drills with pistol grips are the most common type in use today, and are available in a huge variety of subtypes. A less common type is the right-angle drill, a special tool used by tradesmen such as plumbers and electricians. The motor used in corded drills is often a universal motor due to its high power.

As the prices of power tools and suitable electric motors have fallen, however, such attachments have become much less common. A similar practice is currently employed for cordless tools where the battery, the most expensive component, is shared between various motorised devices, as opposed to a single electric motor being shared between mechanical attachment.

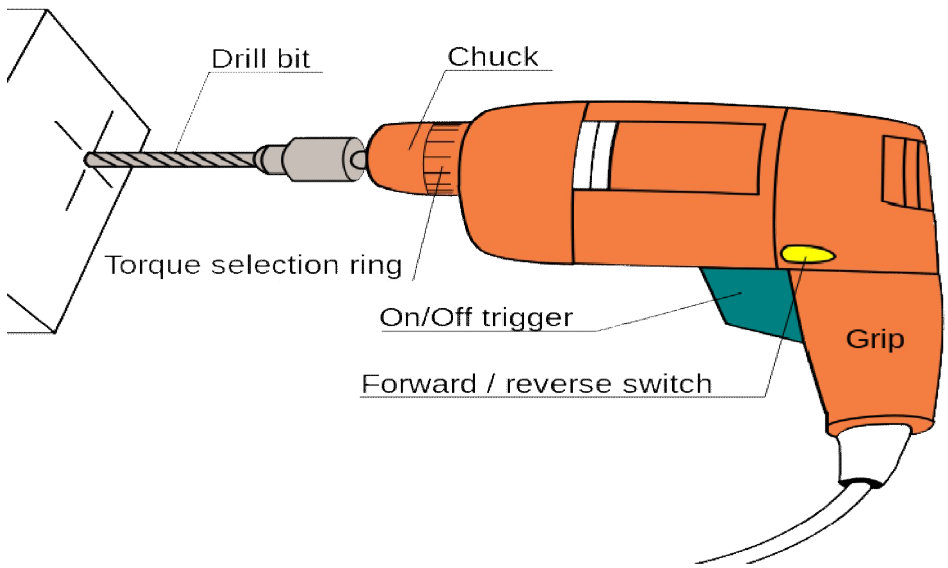


Fig (1-5) Anatomy of a pistol-grip corded drill

Hammer drill

The hammer drill is similar to a standard electric drill, with the exception that it is provided with a hammer action for drilling masonry. The hammer action may be engaged or disengaged as required. Most electric hammer drills are rated (input power) at between 600 and 1100 watts. The efficiency is usually 50-60% i.e. 1000 watts of input is converted into 500-600 watts of output (rotation of the drill and hammering action).

In contrast to the cam-type hammer drill, a rotary/pneumatic hammer drill accelerates only the bit. This is accomplished through a piston design, rather than a spinning cam. Rotary hammers have much less vibration and penetrate most building materials. They can also be used as "drill only" or as "hammer only" which extends their usefulness for tasks such as chipping brick or concrete. Hole drilling progress is greatly superior to cam-type hammer drills, and these drills are generally used for holes of 19 mm (3/4 inch) or greater in size. A typical application for a rotary hammer drill is boring large holes for lag bolts in foundations, or installing large lead anchors in concrete for handrails or benches.

Fig 1-6

Drills can also be used at an angle to join two boards

Rotary hammer drill

The rotary hammer drill (also known as a rotary hammer, roto hammer drill or masonry drill) combines a primary dedicated hammer mechanism with a separate rotation mechanism, and is used for more substantial material such as masonry or concrete. Generally, standard chucks and drills are inadequate and chucks such as SDS and carbide drills that have been designed to withstand the percussive forces are used. Some styles of this tool are intended for masonry drilling only and the hammer action cannot be disengaged. Other styles allow the drill to be used without the hammer action for normal drilling, or hammering to be used without rotation for chiseling.

Fig 1-7

A rotary hammer drill used in construction

Cordless drills

A cordless drill is an electric drill which uses rechargeable batteries. These drills are available with similar features to an AC mains-powered drill. They are available in the hammer drill configuration and most have a clutch, which aids in driving screws into various substrates while not damaging them. Also available are right angle drills, which allow a worker to drive screws in a tight space. While 21st century battery innovations allow significantly more drilling, large diameter holes (typically 12–25 mm (0.5–1.0 in) or larger) may drain current cordless drills quickly.

Fig 1-8 Cordless drill

Drill press

A drill press (also known as a pedestal drill, pillar drill, or bench drill) is a fixed style of drill that may be mounted on a stand or bolted to the floor or workbench. Portable models with a magnetic base grip the steel workpieces they drill. A drill press consists of a base, column (or pillar), table, spindle (or quill), and drill head, usually driven by an induction motor. The head has a set of handles (usually 3) radiating from a central hub that, when turned, move the spindle and chuck vertically, parallel to the axis of the column. The table can be adjusted vertically and is generally moved by a rack and pinion; however, some older models rely on the operator to lift and reclamp the table in position. of *swing*. Swing is defined as twice the *throat distance*, which is the distance from the A drill press has a number of advantages over a hand-held drill:

- Less effort is required to apply the drill to the workpiece. The movement of the chuck and spindle is by a lever working on a rack and pinion, which gives the operator considerable mechanical advantage
- The table allows a vise or clamp to be used to position and restrain the work, making the operation much more secure
- The angle of the spindle is fixed relative to the table, allowing holes to be drilled accurately and consistently
- Drill presses are almost always equipped with more powerful motors compared to hand-held drills. This enables larger drill bits to be used and also speeds up drilling with smaller bits.

Drill presses are often used for miscellaneous workshop tasks other than drilling holes. This includes sanding, honing, and polishing. These tasks can be performed by mounting sanding drums, honing wheels and various other rotating accessories in the chuck. This can be unsafe in some cases, as the chuck arbor, which may be retained in the spindle solely by the friction of a taper fit, may dislodge during operation if the side loads are too high.

1.3 VIBRATION

Vibration is a mechanical phenomenon whereby oscillations occur about an equilibrium point. The oscillations may be periodic such as the motion of a pendulum or random such as the movement of a tire on a gravel road.

Vibration is occasionally "desirable". For example, the motion of a tuning fork, the reed in a woodwind instrument or harmonica, or mobile phones or the cone of a loudspeaker is desirable vibration, necessary for the correct functioning of the various devices.

More often, vibration is undesirable, wasting energy and creating unwanted sound – noise. For example, the vibration motions of engines, electric, or any mechanical device in operation are typically unwanted. Such vibrations can be caused by imbalances in the rotating parts, uneven friction, the meshing of gear teeth, etc. Careful designs usually minimize unwanted vibrations.

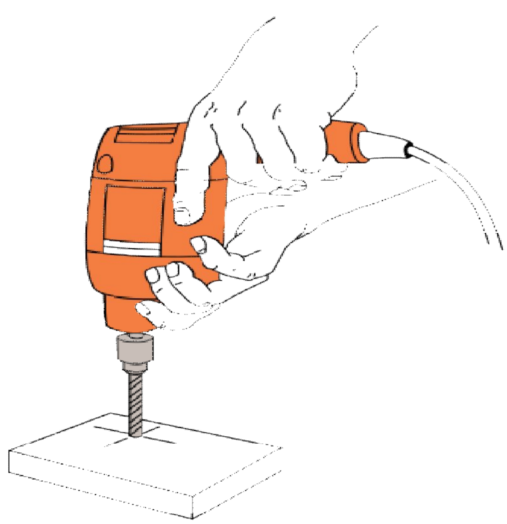


Fig 1-12 hand drilling operation

1.4 Types of vibration:

Free vibration occurs when a mechanical system is set off with an initial input and then allowed to vibrate freely. Examples of this type of vibration are pulling a child back on a swing and then letting go or hitting a tuning fork and letting it ring. The mechanical system will then vibrate at one or more of its "natural frequency" and damp down to zero.

Forced vibration is when a time-varying disturbance (load, displacement or velocity) is applied to a mechanical system. The disturbance can be a periodic, steady-state input, a transient input, or a random input. The periodic input can be a harmonic or a non-harmonic disturbance. Examples of these types of vibration include a shaking washing machine due to an imbalance, transportation vibration (caused by truck engine, springs, road, etc.), or the vibration of a building during an earthquake. For linear systems, the frequency of the steady-state vibration response resulting from the application of a periodic, harmonic input is equal to the frequency of the applied force or motion, with the response magnitude being dependent on the actual mechanical system.

1.5 Vibration testing

Vibration testing is accomplished by introducing a forcing function into a structure, usually with some type of shaker. Alternately, a DUT (device under test) is attached to the "table" of a shaker. Vibration testing is performed to examine the response of a device under test (DUT) to a defined vibration environment. The measured response may be fatigue life, resonant frequencies or squeak and rattle sound output (NVH). Squeak and rattle testing is performed with a special type of *quiet shaker* that produces very low sound levels while under operation.

For relatively low frequency forcing, servohydraulic (electrohydraulic) shakers are used. For higher frequencies, electrodynamic shakers are used. Generally, one or more "input" or "control" points located on the DUT-side of a fixture is kept at a specified acceleration. Other "response" points experience maximum vibration level (resonance) or minimum vibration level (anti-resonance). It is often desirable to achieve anti-resonance in order to keep a system from becoming too noisy, or to reduce strain on certain parts of a system due to vibration modes caused by specific frequencies of vibration.

Devices specifically designed to trace or record vibrations are called vibroscopes.

Free vibration without damping

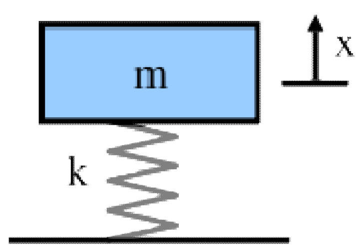


Fig 1-13

Free vibration without damping

To start the investigation of the mass–spring–damper assume the damping is negligible and that there is no external force applied to the mass (i.e. free vibration). The force applied to the mass by the spring is proportional to the amount the spring is stretched "x" (we will assume the spring is already compressed due to the weight of the mass). The proportionality constant, k, is the stiffness of the spring and has units of force/distance (e.g. lbf/in or N/m). The negative sign indicates that the force is always opposing the motion of the mass attached to it:

$$F_s = -kx.$$

The force generated by the mass is proportional to the acceleration of the mass as given by Newton's second law of motion :

$$\Sigma F = ma = m\ddot{x} = m\frac{d^2x}{dt^2}.$$

The sum of the forces on the mass then generates this ordinary differential equation: $m\ddot{x} + kx = 0.$

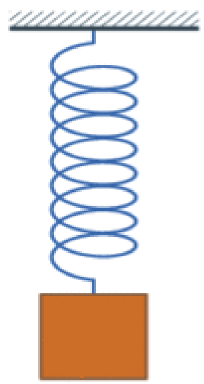


fig 1-14

Simple harmonic motion of the mass-spring system

Assuming that the initiation of vibration begins by stretching the spring by the distance of *A* and releasing, the solution to the above equation that describes the motion of mass is:

$$x(t) = A\cos(2\pi f_n t).$$

This solution says that it will oscillate with simple harmonic motion that has an amplitude of A and a frequency of f_n. The number f_n is called the undamped natural frequency. For the simple mass–spring system, f_n is defined as:

$$f_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}.$$

Note: angular frequency ω (ω=2 π *f*) with the units of radians per second is often used in equations because it simplifies the equations, but is normally converted to "standard" frequency (units of Hz or equivalently cycles per second) when stating the frequency of a system.

Free vibration with damping

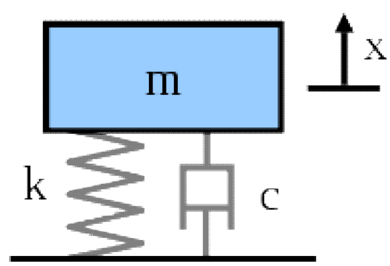


Fig 1-15 Mass Spring Damper Mode

When a "viscous" damper is added to the model that outputs a force that is proportional to the velocity of the mass. The damping is called viscous because it models the effects of a fluid within an object. The proportionality constant *c* is called the damping coefficient and has units of Force over velocity (lbf s/ in or N s/m).

$$F_d = -cv = -c\dot{x} = -c\frac{dx}{dt}.$$

Summing the forces on the mass results in the following ordinary differential equation:

$$m\ddot{x} + c\dot{x} + kx = 0.$$

The solution to this equation depends on the amount of damping. If the damping is small enough the system will still vibrate, but eventually, over time, will stop vibrating. This case is called underdamping – this case is of most interest in vibration analysis.

Forced vibration with damping

The behavior of the spring mass damper model varies with the addition of a harmonic force. A force of this type could, for example, be generated by a rotating imbalance.

$$F = F_0 \sin(2\pi f t).$$

Summing the forces on the mass results in the following ordinary differential equation:

$$m\ddot{x} + c\dot{x} + kx = F_0 \sin(2\pi f t).$$

The steady state solution of this problem can be written as:

$$x(t) = X \sin(2\pi f t + \phi).$$

The result states that the mass will oscillate at the same frequency, *f*, of the applied force, but with a phase shift ϕ.

The amplitude of the vibration "X" is defined by the following formula.

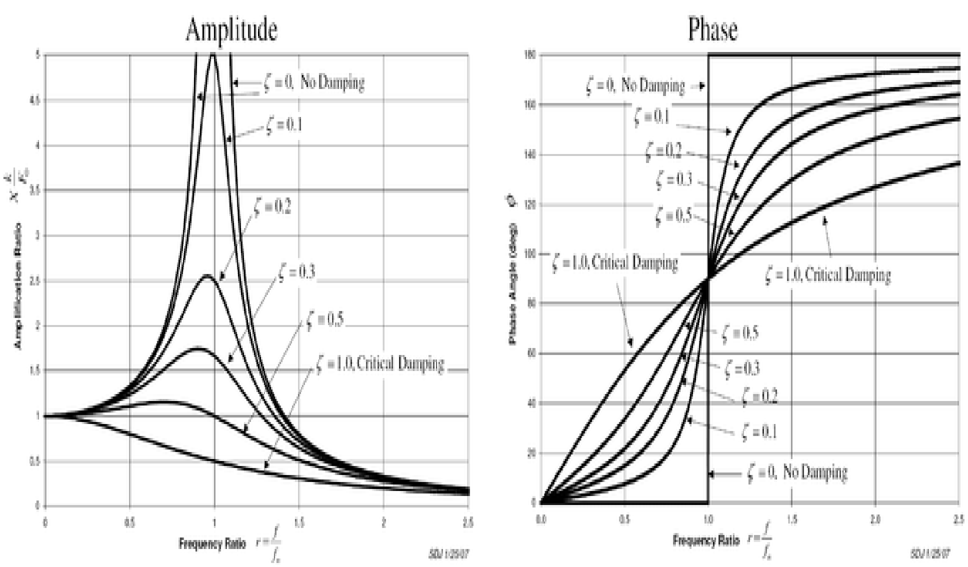
$$X = \frac{F_0}{k}\frac{1}{\sqrt{(1-r^2)^2+(2\zeta r)^2}}.$$

Where "r" is defined as the ratio of the harmonic force frequency over the undamped natural frequency of the mass–spring–damper model.

$$r = \frac{f}{f_n}.$$

The phase shift ϕ, is defined by the following formula.

$$\phi = \arctan\left(\frac{2\zeta r}{1-r^2}\right).$$



The plot of these functions, called "the frequency response of the system", presents one of the most important features in forced vibration. In a lightly damped system when the forcing frequency nears the natural frequency ($r \approx 1$) the amplitude of the vibration can get extremely high. This phenomenon is called resonance (subsequently the natural frequency of a system is often referred to as the resonant frequency). In rotor bearing systems any rotational speed that excites a resonant frequency is referred to as a critical speed.

CHAPTER 2

LITERETURE REVIEW

Many dedicated researchers have done their research projects on micro machining processes from various part of the world. The survey consists of some of the journal papers by them which are discussed below.

Mirta Widia and Siti Zawiah Md Dawal[1] investigated upon turning process by taking cutting speed, feed rate, depth of cut and nose radius as process parameters, and outputs are surface roughness and power consumption optimized by Grey Based Taguchi method. His experiments are based upon AISI304 stainless steel by taking Taguchi's L27 orthogonal array in design of experiment. He found that cutting speed of 100m/min, feed rate of 0.1mm/rev, depth of cut of 0.2mm and nose radius of 0.4mm are the optimal conditions to decrease surface roughness from 1.74µm to 1.14µm and power consumption from 320watts to 245watts. Again he added that cutting speed influences 35.47%, followed by feed rate 26.12%, depth of cut 18.16% and nose radius by 10.63%.

Shih-Hsing et al [2] investigated on optimization of injection molding process in glass fiber reinforced polycarbonate composites as work piece by using grey relational analysis. The experiment is examined by CAE software package for forecasting the shear layer thickness and L9 Orthogonal array is taken with 4 process parameters i.e. filling time, melt temperature, die temperature and ram speed in 3 levels. He found that the quality of product was improved by 20% which is dramatically increased productivity by improvement of quality of part, reducing rejects by cycle time, inspection time, cost and scrap and gave better scheduling in product.

Bharat Kumar Bhallam Venkata[3] reported on wear property of fiber-reinforced poly-butylene terephthalate in the injection molding process by nine experimental runs with L9(34) orthogonal array by taking filling time, melt temperature, mold temperature and ram speed with 3 levels. He reported that volume losses by parallel and perpendicular sliding directions are optimized at 2sec of filling time, 260°C of melting temperature, 90°C of molding temperature and 100% of ram speed.

Chen Ming-Fei et al [4] reported upon the optimization of direct CO2 laser cutting process in PMMA of 6mm thickness by using grey relational analysis. They have taken 3 levels of 4 process parameters like assisted gas flow rate, laser repetition frequency, cutting speed and laser defocused position, and their responses are surface roughness and optical transmittance ratio. They concluded that the assisted-gas flow rate and beam focus depth have largest effects on the quality of cut surface for direct laser cutting process, and the optimum parameters are 20NL/min of gas flow rate, 5 kHz of laser pulse repetition frequency, 2mm/s of cutting speed and position of focus on material is Zero.

Senthil Kumar Velusamy and Uday Omprakash Bidwai [5] have been experimented on the effectiveness of current, pulse on-time, flushing pressures which are input in the electrical discharge machining process. In the hand the outputs are metal removal rate, tool wear rate of sintered aluminumalloy with 5% and 2.5% of TiC reinforcement. They found that increase in flushing pressure increased EWR in case of second reinforcement. But, the 1st reinforcement is different due to the formation of bigger size of craters TWR is slightly decreased.

P Matoorian et al [6] have investigated on the optimization method in electrical discharge turning process on the orthogonal array of L18 orthogonal array in which design of experiment has been done. They are taken process parameters as intensity, time in pulse-on and pulse-off, voltage, servo and rotational speed.

CHAPTER 3.

OPTIMIZATION OF DRILLING PARAMETERS

Drilling optimization is conducted considering that the rig equipment, bottom hole assembly (BHA), and the bit to be used are already the optimum selections in the scope of this real-time optimization study. In order to achieve the objective of minimum cost drilling the bit should be prevented from damages when run into the hole.Mathematical model for the penetration rate could be written as a function of drilling parameters such as WOB/db, RPM, as given in equation (5.1). Also the bit tooth wear has been considered in the same equation for the optimization

$$\frac{dF}{dt} = f(\frac{W}{d_b}, N, h)$$

Drilling cost per foot equation is as defined in equation (5.4). It has been defined to be a function of daily rig rate, bit cost, and timing required in the course of the bit runs. This equation is known to be the mostly applied drilling cost formula in the

$$C_f = \frac{C_b + C_r\left(t_t + t_c + t_b\right)}{\Delta F}$$

where, Cf is the cost per drilled interval, Cr is the daily rig rate, Cb is the bit cost, tt round trip time, tc connection time, hr, and tb bit drilling time. ΔF is the footage drilled with the bit in the use, ft. Bit drilling time, tb, (with respective to tooth wear), equation (C.3), and drilling interval, ΔF, (with respect to general drilling functions and tooth wear), equation (C.12) when inserted into equation (4.4), after modifying the same, the cost per for equation could be redefined.

$$C_f = \frac{C_r}{\left(J_1 e^{(-a_7 h)}\right) J_2 \tau_H \left(1 + H_2 h\right) dh} \left(\frac{C_b}{C_r} + t_t + t_c + J_2 \tau_H \int_0^{h_f} (1 + H_2 h) dh \right)$$

$$f'(C_f) = \frac{\partial(C_f)}{\partial(W/d_b)} =$$

$$\frac{C_r}{e^{(-a_7 h)} U dh} \left[-\frac{\text{N}}{\zeta}\frac{1}{\psi}\frac{1}{[B]}\frac{a_5}{(A)} + \frac{\text{N}}{\zeta}\frac{1}{\psi}\frac{1}{\left(\left(\frac{W}{d_b}\right)_m - \left(\frac{W}{d_b}\right)\right)^2}\left(4 - \left(\frac{W}{d_b}\right)_t\right) - \frac{\int_0^{h_f} Ud}{\theta} \right.$$

Where;

$$U = (1 + H_2 h)$$

$$\text{N} = \left[\frac{C_b}{C_r} + t_t + t_c \right]$$

$$\zeta = \left(e^{a_1} e^{a_2 X_2} e^{a_3 X_3} e^{a_4 X_4} e^{a_6 X_6} e^{a_8 X_8}\right)\left(\left(\frac{60}{N}\right)^{H1}\right)\left(\left(\frac{1}{1 + \frac{H_2}{2}}\right)\tau_H\right)$$

The solution of the respective derivative for equation (5.15) is as give The optimum equation for the weight for each diameter of bit size is as given below, equation (5.17)

$$\left[\frac{W}{d_b}\right]_{Opt} = \frac{a_5 H_1 \left(\frac{W}{d_b}\right)_{\max} + a_6 \left(\frac{W}{d_b}\right)_t}{a_5 H_1 + a_6}$$

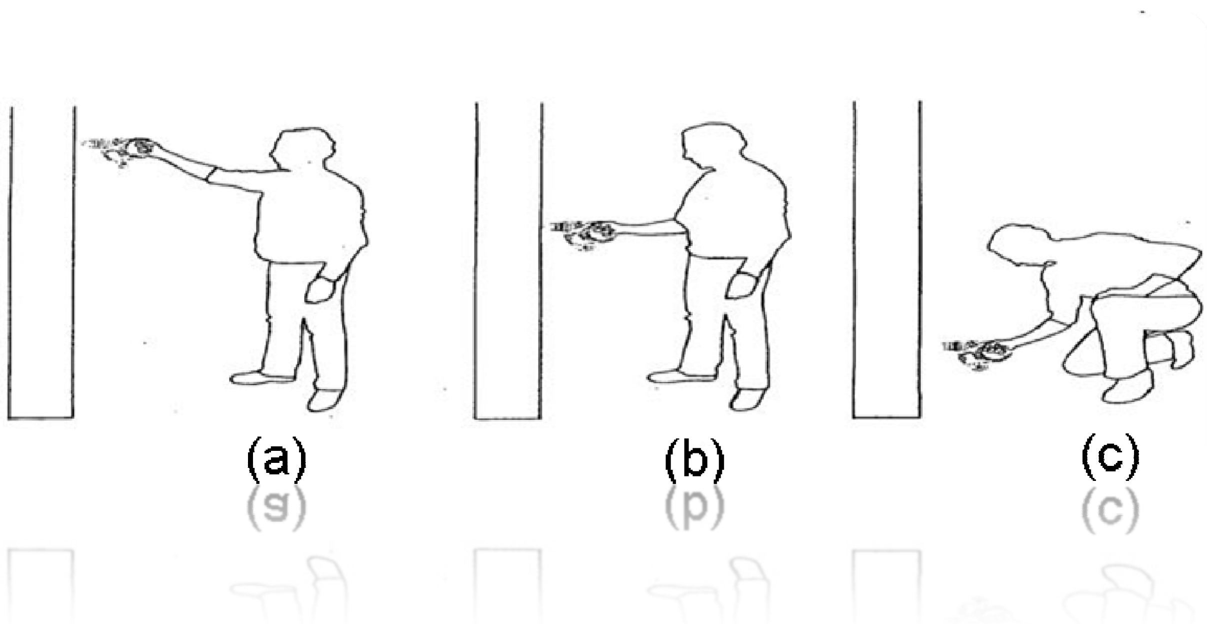
.

$$\left[\frac{W}{d_b}\right]_{Opt} = \frac{a_5 H_1 \left(\frac{W}{d_b}\right)_{\max} + a_6 \left(\frac{W}{d_b}\right)_t}{a_5 H_1 + a_6}$$

CHAPTER 4

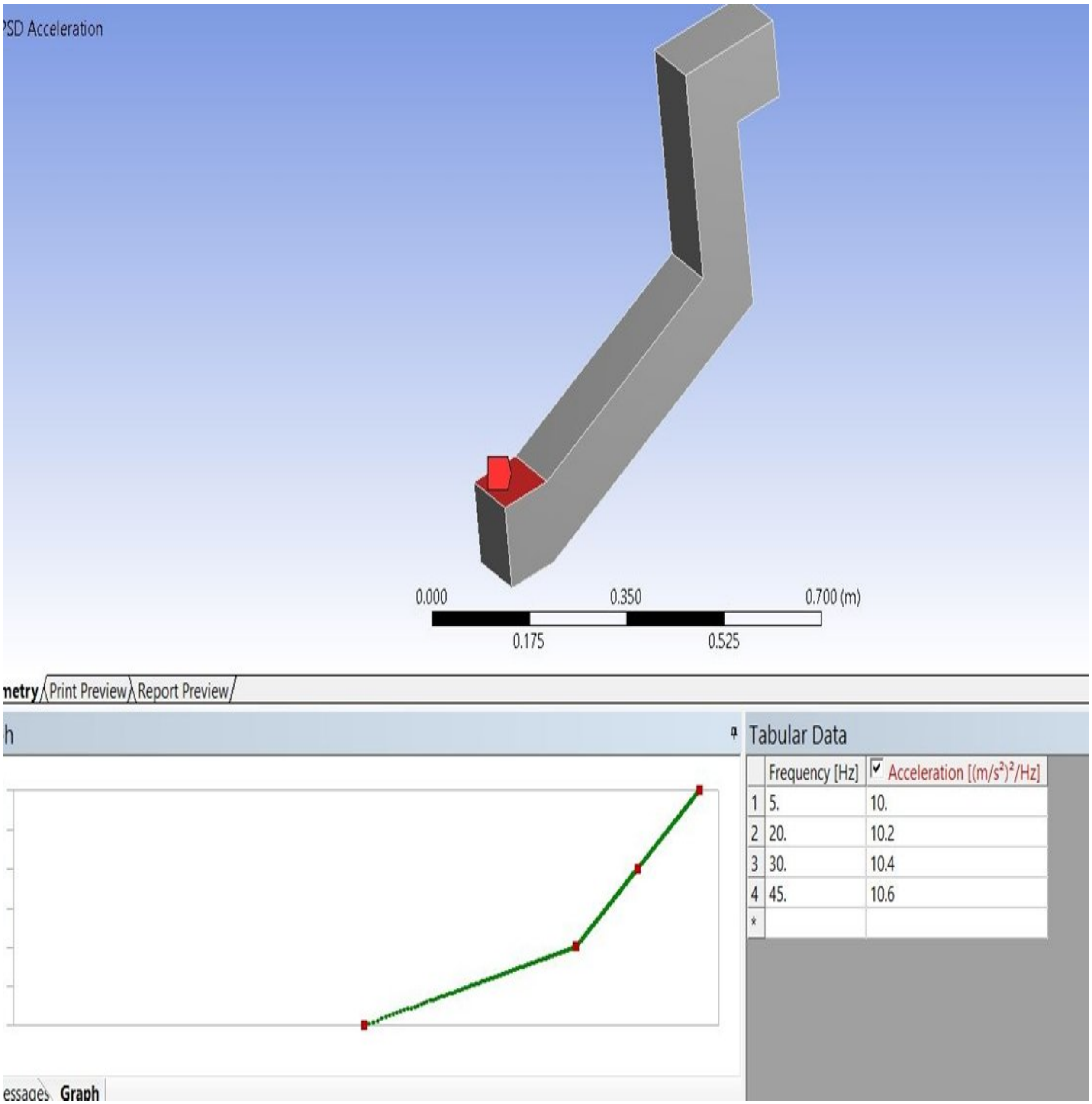
SIMULATION RESULTS

4.1) DIFFERENT DRILLING POSITIONS



4.2.a) Setup-a-Acceleration Analysis

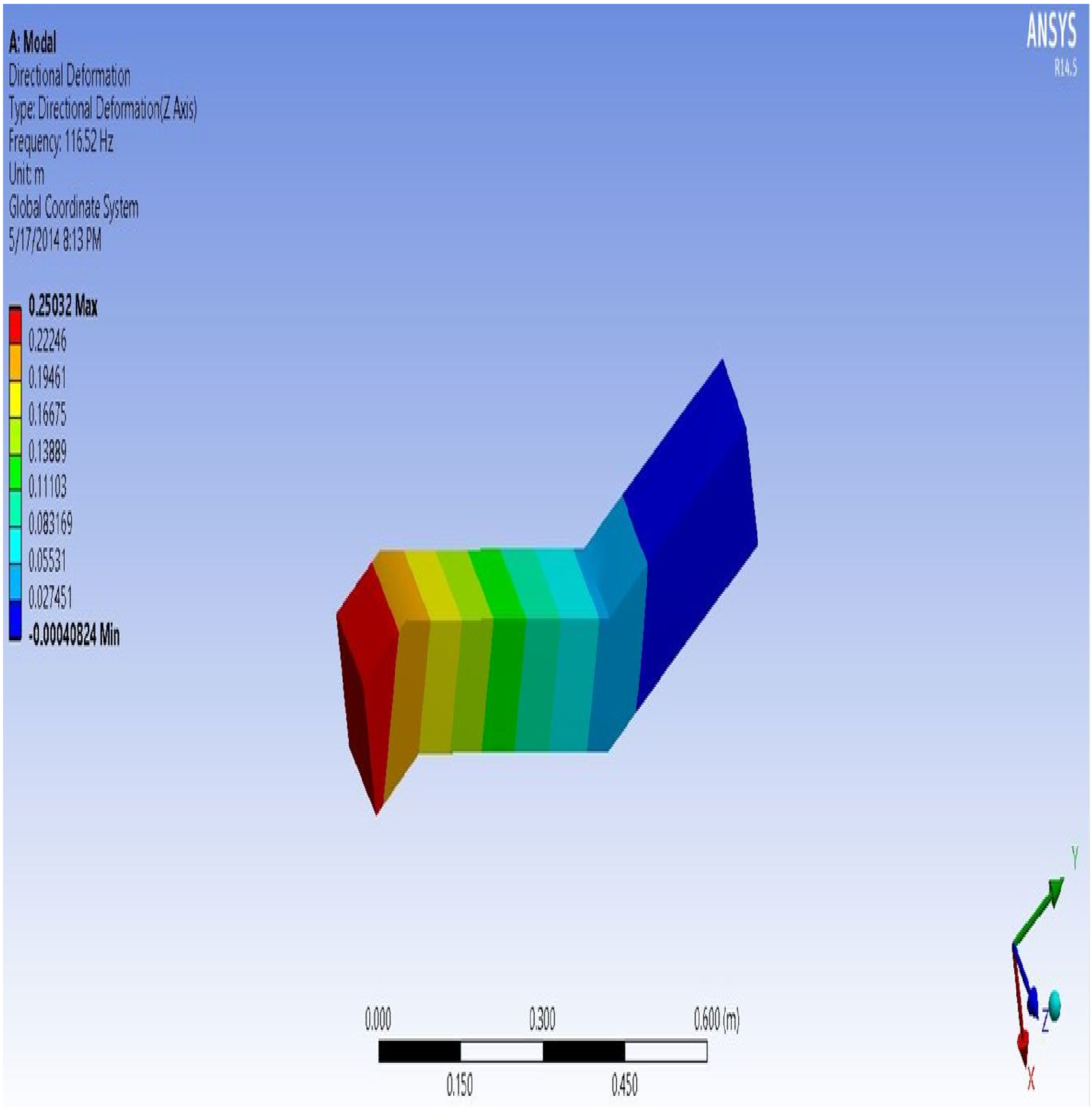
DESIGN 1



	Frequency [Hz]	Acceleration [(m/s²)²/Hz]
1	5.	10.
2	20.	10.2
3	30.	10.4
4	45.	10.6
*		

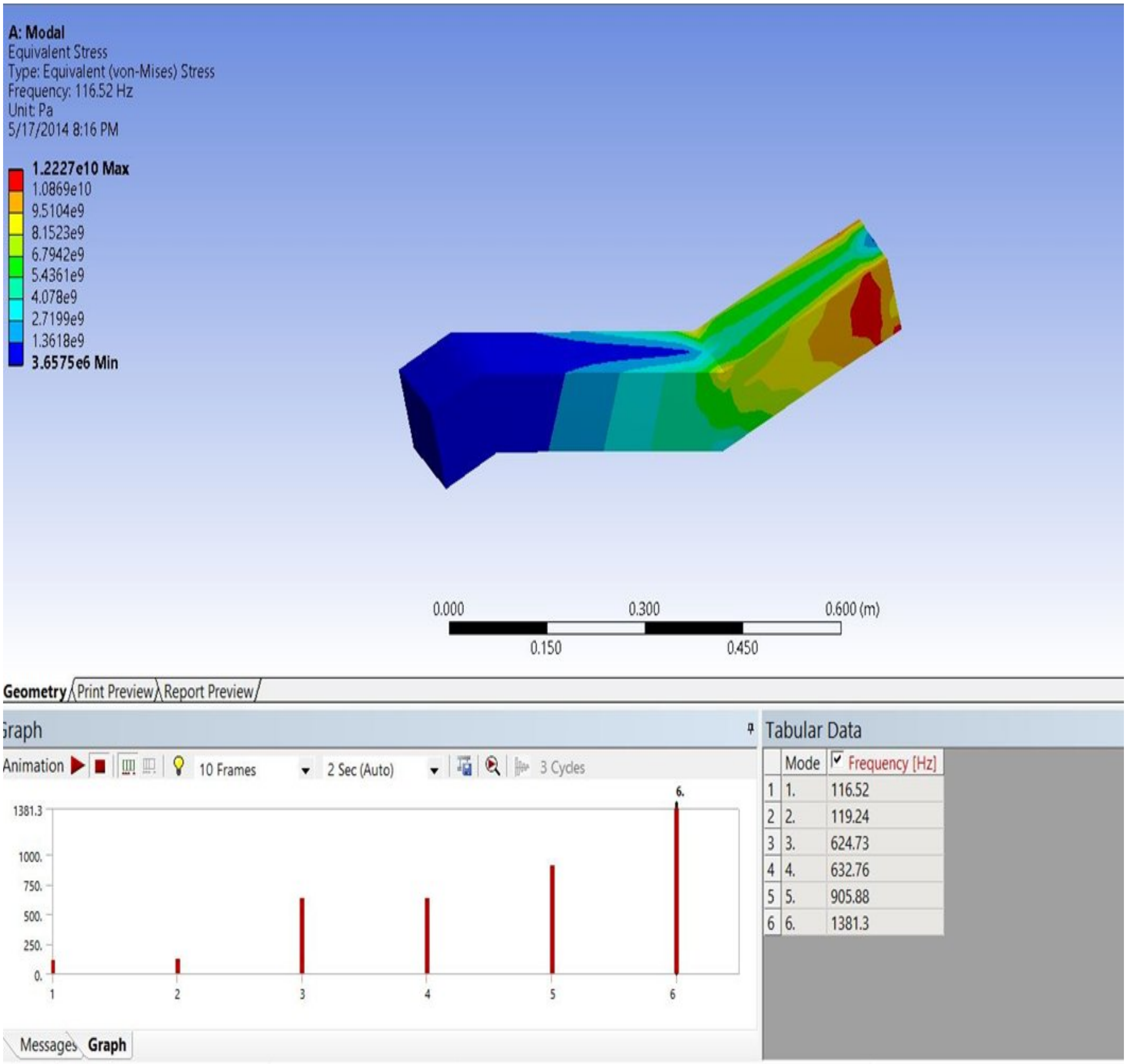
In this part of simulation different values of frequency and as a result we get different values of acceleration .As the frequency or vibration of hand drilling machine increases as the acceleration also increasing .

4.2.b)Setup-a- Directional-deformation(Z Axis) Analysis



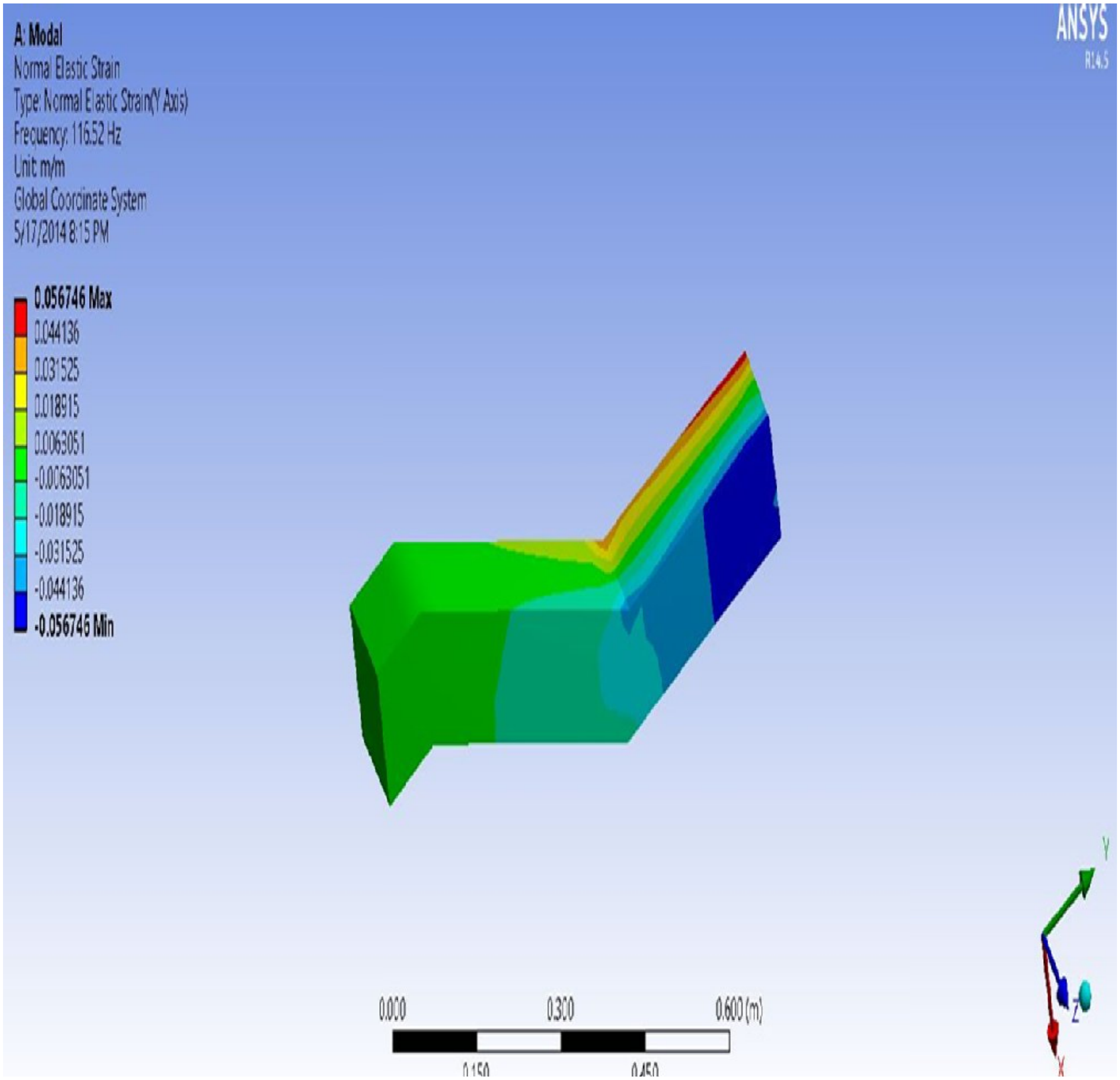
Here the directional deformation (Z axis) is calculated by giving different values of frequency and that results that directional deformation value is higher at wrest area.

4.2,c) Directional-normal-elastic-equivalant-stress Analysis



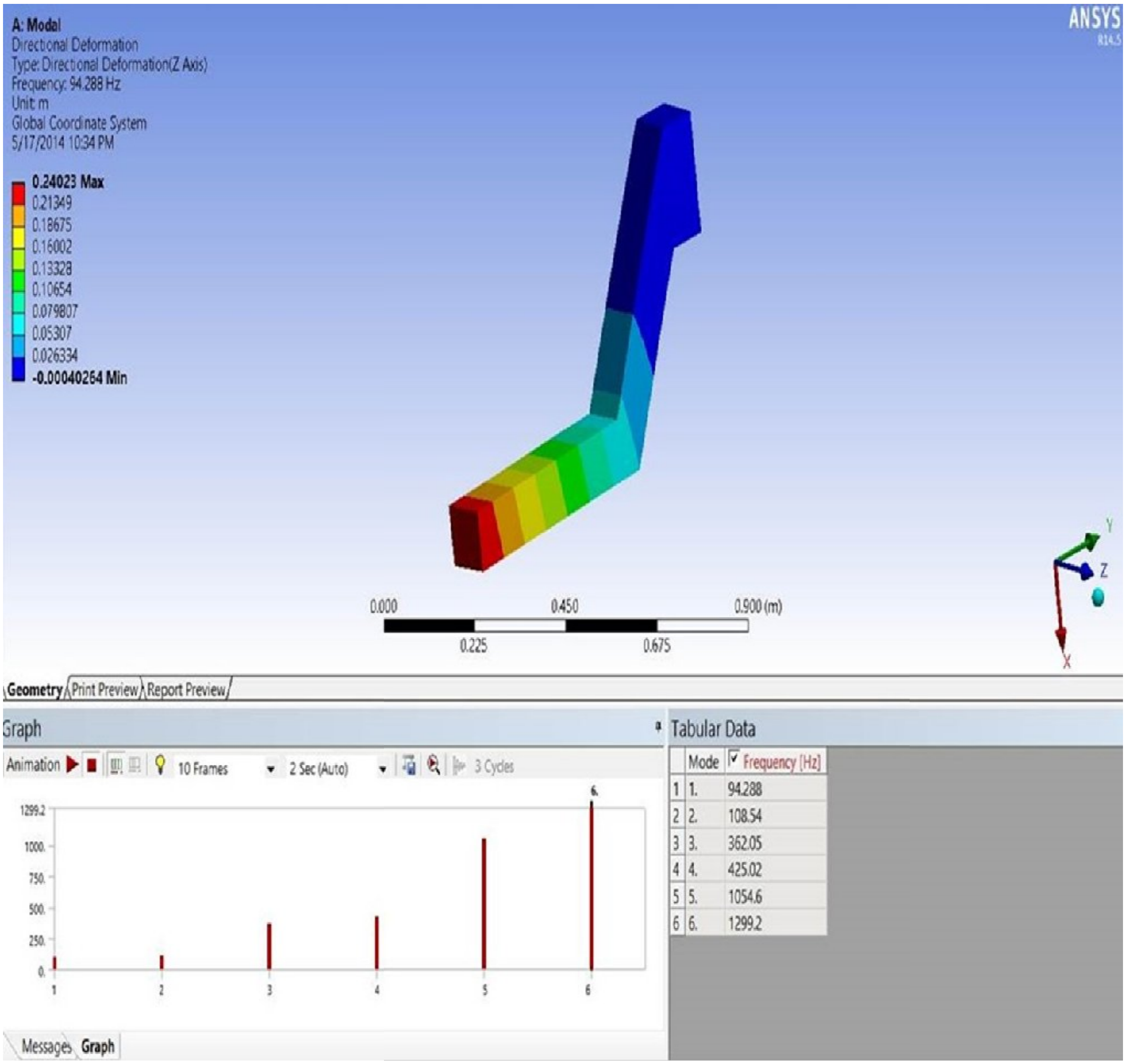
Here again Directional-normal-elastic-equivalant-stress is calculated on the basis of frequency here at first value of frequency the value of Directional-normal-elastic-equivalant-stress is zero later on it increasing with the value of frequency increases .

4.3.a)Setup-2- Direction



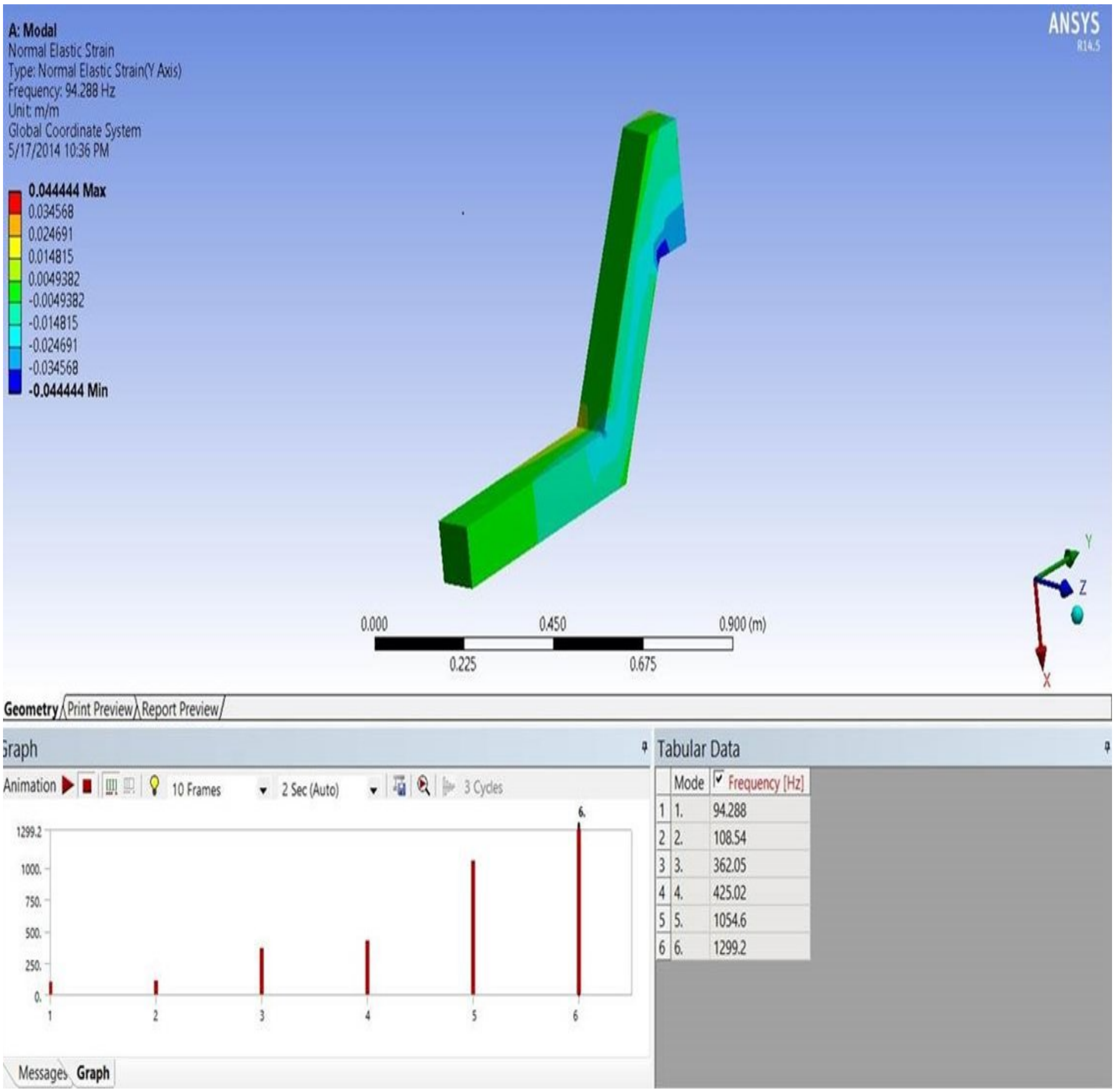
Here the value of elastic strain is calculated by giving different value of frequencies and its value is maximum at lower arm at bicep area.

4.3.b)Setup-b-Directional Deformation

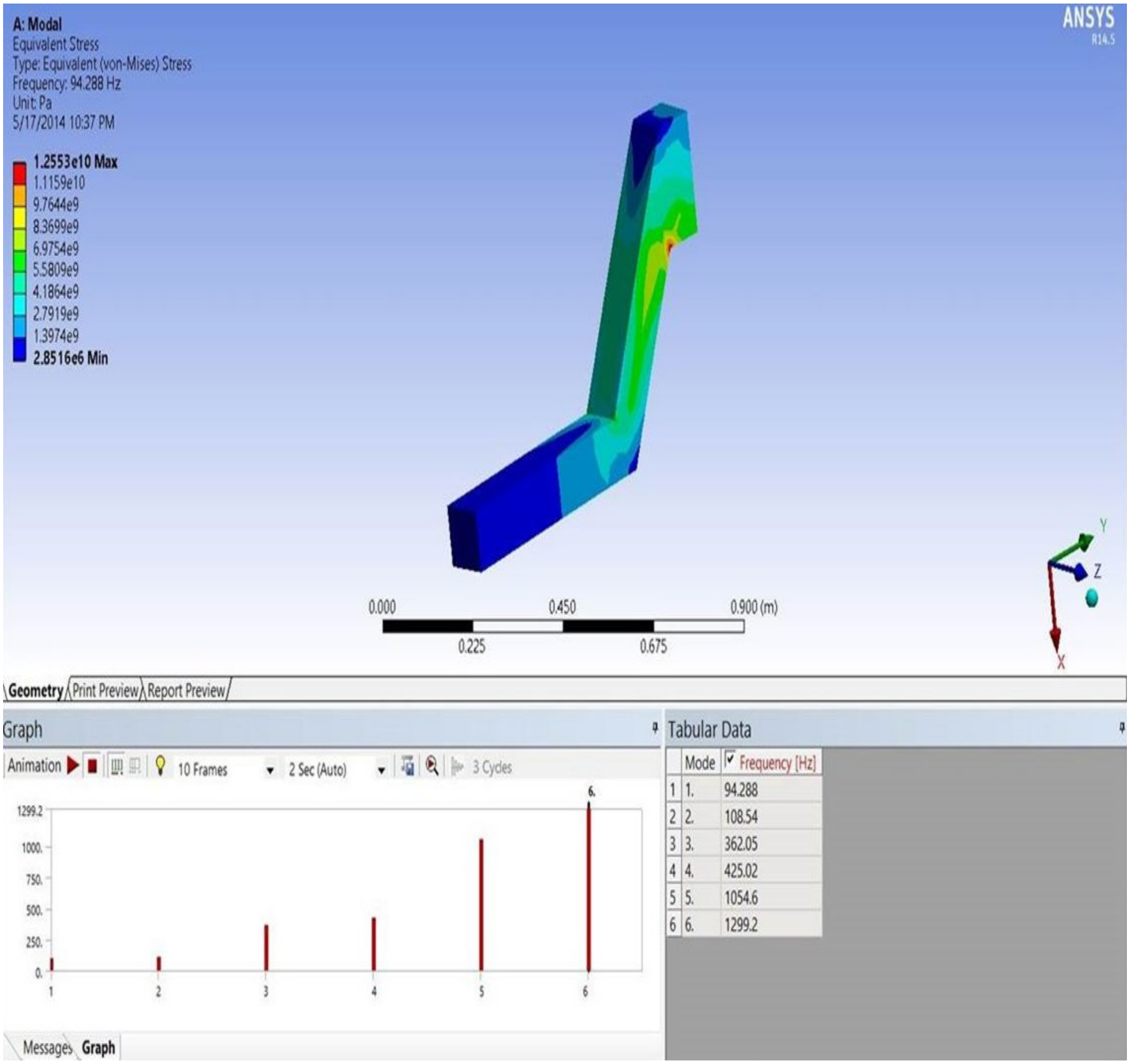


Here the directional deformation for second position is determined with giving different values of frequencies and resulted that directional deformation is maximum at wrist position and is minimum at shoulder .

4.3.c) Setup-b-Normal elastic strain analysis

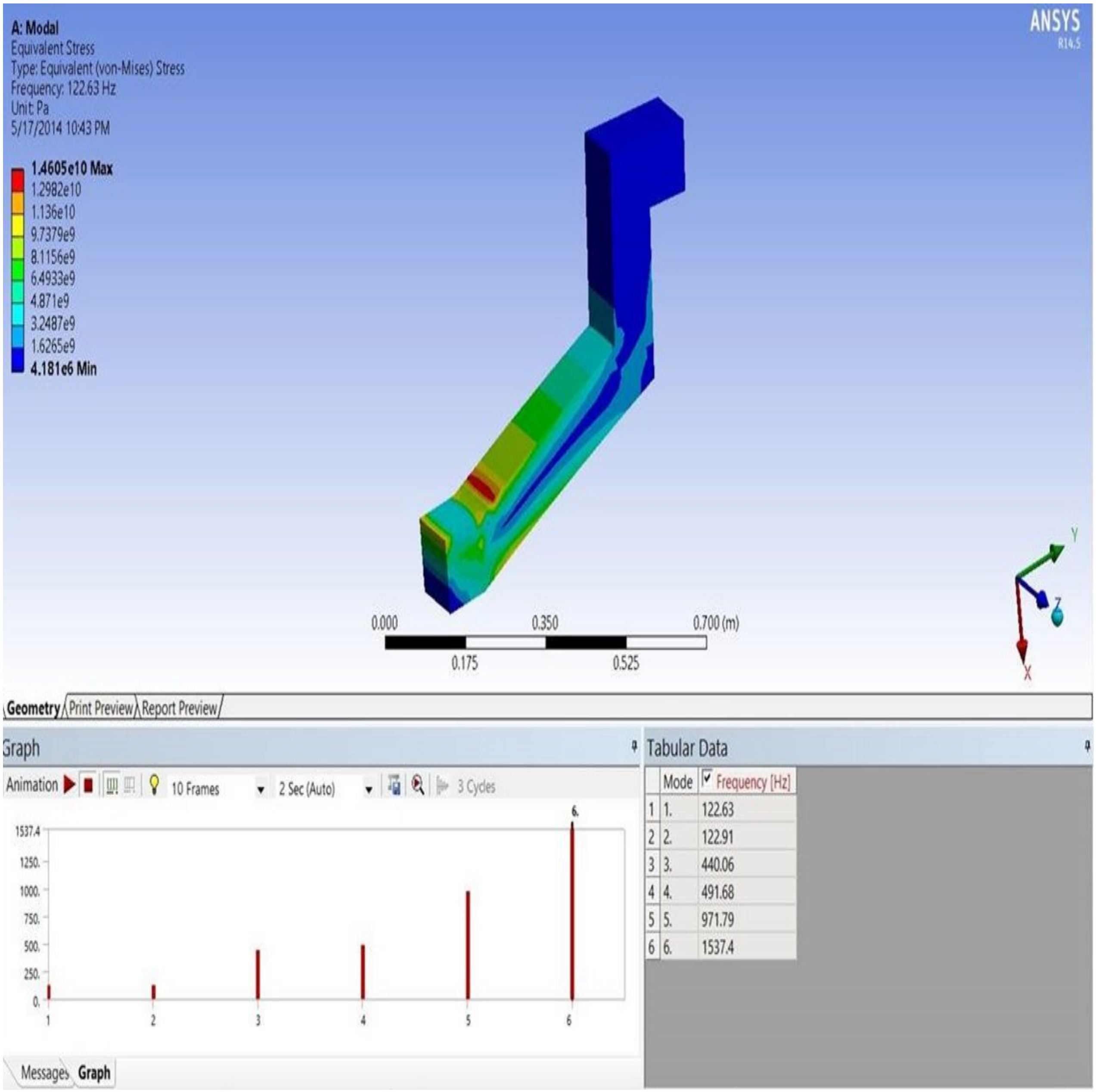


4.4.a) Setup-c-Equivalent stress Analysis



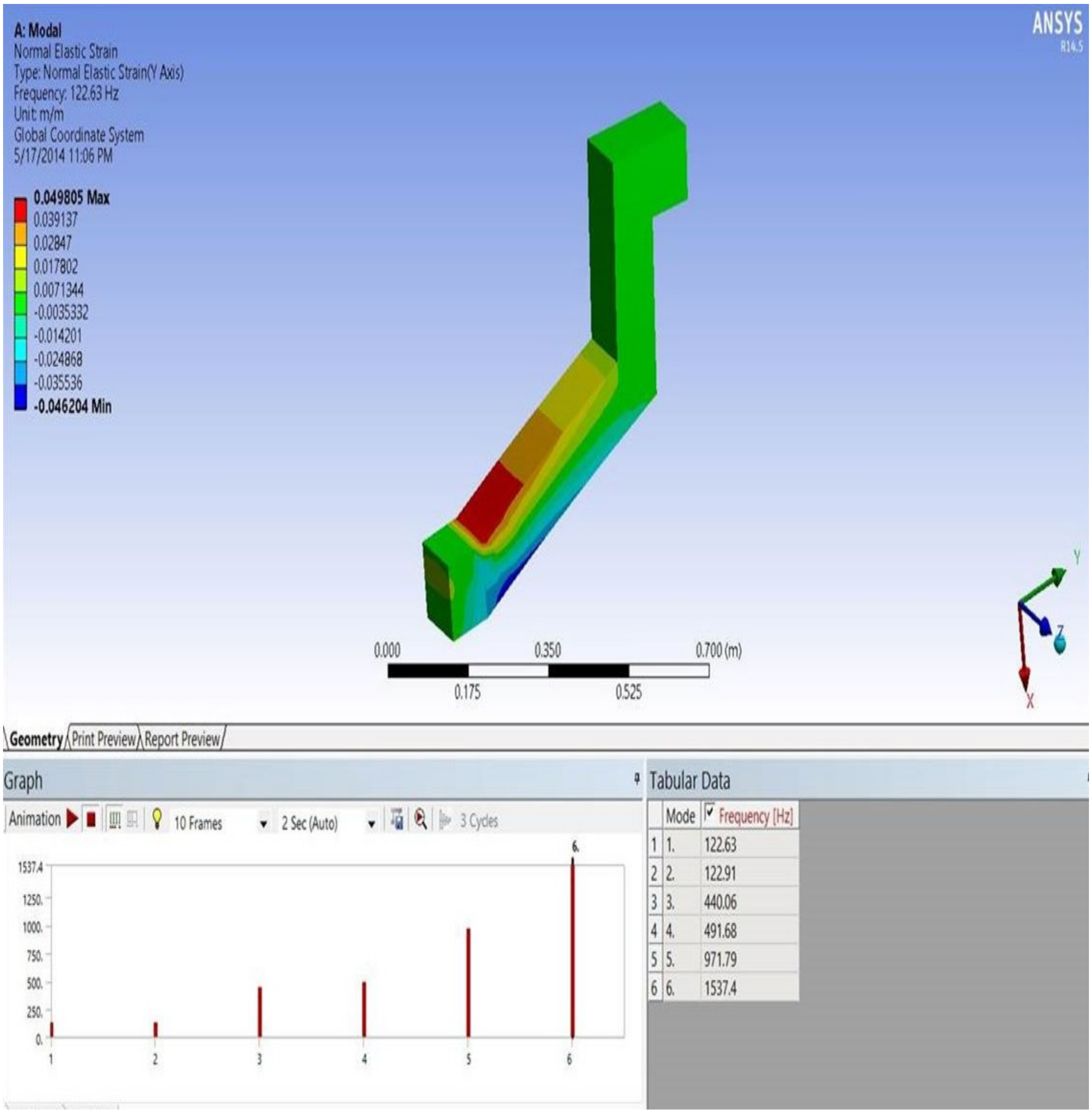
Equivalent stress Analysis is done by giving 6 different frequency values and we came to result that Equivalent stress is minimum at wrist as well as most of the upper arm its values is minimum and is maximum at shoulder joint .

4.4.b) Setup-c-Equivalent stress Analysis



Equivalent stress is determined at different values of frequencies and we get the result that the value of Equivalent stress is maximum after wrist position and its value minimum at lower arm as well as at the shoulder area.

4.4.c) Setup-c-Normal Elastic Strain



	Mode	Frequency [Hz]
1	1.	122.63
2	2.	122.91
3	3.	440.06
4	4.	491.68
5	5.	971.79
6	6.	1537.4

Normal Elastic Strain is computed which is maximum at wrist position and as well as upper arm and its value is extremely minimum at upper arm and shoulder area.

CHAPTER 5

CONCLUTION AND RECOMMENDATION

5.1 CONCLUSION

A real-time drilling optimization methodology was developed and demonstrated applicable to achieve optimum controllable drilling parameters. The foremost task of this study is to optimize the drilling parameters. The data used in the scope of this study was belonging to wells drilled in Mediterranean Offshore. The optimum drilling parameters are the parameters which are determined through the multiple regression technique to give minimum drilling cost. Results indicated that drilling costs were able to be reduced in real-time provided that optimum controllable parameters are applied.

Multiple regression technique proved that it could be functioning efficiently during the actual drilling activities, as well as for well planning and drilling scenario construction purposes. ROP performance predictions could be used by means of utilizing of the regression coefficients specific to the formations. It has been observed that with more data quantity the regression coefficient quality achievement has been improved. In the world of drilling optimization technology the rarely sought right answer is predicting rate of penetration beforehand realizing the drilling, and recommending the optimized parameters for the drilling process. Modern well monitoring equipment are required to be used in order to collect the necessary drilling data and to perform multiple regression which determines the constants defined in the general rate of penetration equation.

The study of Bourgoyne and Young [14] and the study presented here are based on analysis of drilling data collected from different drilling locations. For this very reason it should be expected that the coefficients of the general rate of penetration equation following multiple regression are not going to be similar when the drilling locations are different. T-test values indicate that the mean RMS values during with and without overhead support stand were statistically different. The subjects rated the amount of discomfort in the waist region zero which suggests that they did not experience any load in that part of the body while wearing the overhead support stand. All the subjects felt that overhead support stand was better compared to that of without support and felt that it was effective in reducing the load on the muscles. Hence, it can be concluded from the above findings that overhead support stand was effective in reducing the load on the shoulder muscles.

5.2 Recommendations

1. In this experiment, there was no drilling task. In future studies the participant may be asked to perform drilling task so that the exact load on the muscle may be measured. This can be done by using subjective rating and by calculating the forces on the shoulder joints.

2. In this experiment, there was no drilling task. In future studies the participant may be asked to perform drilling task so that the exact load on the muscle may be

measured. This can be done by using subjective rating and by calculating the forces on the shoulder joints.

3. This study would be invaluable if torque considerations were added to the Bourgoyne and Young's approach. Cuttings transport if included as a function into the general rate of penetration would be very useful.

4. One of the most critical tasks in the scope of this study was the determination of the tooth wear on the bit in use. An efficient mechanism could largely contribute to the methodology in case the instant actual tooth wear on the bit could be acquired in real-time. Developing mechanisms transmitting actual tooth wear directly from the bit will be extremely important.

5. The methodology should be modified to be suitable for the application of the given methodology for PDC bits. Use of the PDC bits during drilling activities in recent years has shown significant increases even with directional wells. Generation of a model which can effectively work for the optimization of the drilling operations is going to be an important contribution.

CHAPTER 6

BIBLIOGRAPHY

Muzammil, M., I.A. Khan, F. Hasan, 2003. Effect of Vibration, Feed Force and Exposure Duration on

Operators Performing Drilling Task," J. Human. Ergol, 32: 77-86.

Mirta Widia and Siti Zawiah Md Dawal , 2011. The Effect of Hand-held Vibrating Tools on Muscle Activity and Grip Strength," Australian Journal of Basic and Applied Sciences, 5(11): 198-211.

Bharat Kumar Bhallam Venkata,2003 Effect of overhead drilling support on muscular activity of shoulder,"

Velusamy Senthil Kumar, Bidwai Uday Om Prakash , 2011, "Effect of Titanium Carbide particle addition in the aluminum composite on EDM process parameters," Journal paper in manufacturing process, 60-66

http://en.wikipedia.org/wiki/Drilling

http://www.scribd.com/doc/53131528/Drilling

http://www.scribd.com/doc/40144147/Drills