Theory of deformation and the expression to find it

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When we hit a certain body with force F, it absorbs a certain amount of force which results in the change of shape of the body getting hit or in simple words the body deforms. Absorption of force by the body getting hit results in the motion of the hitting object being not periodic.

• What causes deformation?

Ans: Deformation is a physical property which is possessed by every single particle which a mass m which cease to exist in my opinion. Another property is possessed by all particles which is the capacity to absorb forces, which leads to deformation.

For example: let's say a person with a hammer weighing 5 kg hits a wall with a certain acceleration , it will result in the wall getting deformed or in simple words it will be broken. The reason the wall breaks because it absorbs a certain amount of force from the object hitting it. If an object absorbs a certain amount of force from an external agent it will either result in the displacement or the deformation of the object getting hit.

• Is deformation directly proportional to absorption?

Ans: The short answer would be yes. Let us consider an example, lets say a kid weighing 40 kg hits a car window with a force F1 and a fully grown adult weighing 100 kg does the same thing with a force of F2. Which will most likely result in the breaking the car window? Any person with basic common sense would say the man weighing 100 kg has a higher probability of breaking the car window than the kid weighing 40kg.

• Why is the probability higher in the man's case?

• Ans: Lets us assume in both scenario the acceleration was the exact same. Let us consider it a_1. Still the man would be able to produce a higher magnitude of force due to more mass as force is directly proportional to mass as well as acceleration. So if the man produces a higher magnitude of force , the car window will also absorb more amount of force comparatively which will result in more vibration of the car window and if the magnitude of

force produced by the man makes the car window vibrate beyond a certain extent it will deform or simply break.

• Let us consider another example, let's say a man hits a brick wall with a hammer that weighs m and with an acceleration of a. If the man hits a titanium metal cube with the same force, which is going to deform more? The simple answer would be the brick wall, the reason there will be close to no deformation on the titanium cube is because it has a higher density. It has an approx. density of 4.5 g/cm^3, which means that it has a huge number of molecules packed up in a very small area which results in it being stronger. So, it won't absorb a lot of force which will result in a higher rebound distance of the hammer. Titanium refuses to absorb a good amount of force, so the deformation would also be very less and the vibration on the titanium will also be very less. So, we can say that deformation of a body is inversely proportional to it's density.

• Now, let us consider the factors on which the deformation depend on , the first one is density as we have discussed before , the second is the mass of the object which is used to hit. A 5 kg hammer with acceleration a will be able to produce more vibration which will result in more deformation than a hammer which weighs 2.5 kg. Next factor is the displacement of the object which , this the reason labour's swing their hammer before hitting the , more distance will allow more space to accelerate which will result in more magnitude of force getting transferred. Next one is the velocity of the object (hammer) while striking, more velocity will ensure a higher vibration, which will lead to a higher deformation, a bullet hitting a wall won't be the as a cotton ball hitting the (velocity difference plays a major role in this case).The last one is the cross sectional area of the hammer which we are using to hit, less area will ensure more pressure , which again will ensure more absortion(vibration) and will automatically result in a higher deformation.

• Let us see the expression : Here Dnet denotes the net deformation , which is equal to mass times distance to accelerate times velocity/ density

of the object getting hit times area of the object which hits. Unit: Anirudh

Define one Anirudh.

Ans: 1 Anirudh is when an object of density 1m³, is hit by a body with 1Kg mass with the accelerating distance of 1m , with a striking velocity of 1ms⁻¹ and a cross sectional area of 1m² of the object which hits.

Expression