Young’s modulus

Young’s modulus is a measure of the stiffness or rigidity of a material. It only applies to small amounts of elongation or compression which are reversible and do not cause permanent deformation when the exterior applied force is removed. It provides a direct indication of the extent of the distortion that can be expected for a given (small) load. A stiff material has a high Young's modulus and changes its shape only slightly under elastic loads (e.g. diamond). A flexible material has a low Young's modulus and changes its shape considerably (e.g. rubbers), Without this quantity, comparing the rigidity of any two materials is difficult.

And also they call it elastic modulus , because young's modulus is the most common elastic modulus used .

Young's modulus can also be used in computing tension, where the atoms are pulled apart instead of squeezed together. In those cases, the strain is negative because the atoms are stretched instead of compressed. The main concept that is either case it is that the stiffness of the forces between the atoms that is being measured, whether they are being compressed or stretched. Consequently, the pressure computed for Young's modulus does not change for either kind of measurement.

Young’s modulus muscle

They used Young’s modulus in many things in the muscles and also for many calculation and this is some point why i study it about Young’s modulus in the muscle .

1. In the quantitative measurement of the distribution of Young’s modulus (i.e., local muscle stiffness) within or between muscles could improve the accuracy of assessment of muscle stiffness.
2. Young’s modulus distributions within and between multiple muscles in various conditions obtained as a colour-coded image with this new stand-alone mobile technology.We predicted that Young’s modulus of a muscle is greater in conditions with increased muscle contraction intensity, because muscle stiffness is known to increase with contraction intensity.
3. The complex Young's modulus of relaxed muscle fibres as well as muscle fibres in rigor state are frequency dependent.In both cases the complex Young's modulus increases smoothly with increasing frequency over a range of 250 Hz up to 40 kHz.
4. Elastic modulus can be used to estimate an index of individual muscle force during a submaximal isometric fatiguing contraction.

Young’s modulus device

The importance of having a device that can measure the Young’s modulus of small tissue samples. First, by measuring the elastic properties of tumors and lesions compared to normal tissue. Can help identify diseases detectable with elasticity imaging, and even may aid differential diagnosis based on quantitative elastic modulus data for different pathological processes.

Young’s modulus bone

Young’s modulus is used in many calculation in the bone and this same point .

1. The Young's modulus of bone strongly depends on the spatial structure.
2. Determining the elastic modulus of bone tissue on a microstructural level is important for understanding the mechanical behavior and function of bone.
3. Cancellous (or trabecular) bone It has a much lower Young’s modulus than cortical bone, and this graded modulus gradually matches the properties of the cortical bone to the cartilage that forms the articulating surface on the femoral head.
4. The low Young’s modulus of biomaterials is required because it should be as close as possible to that of bone. Although titanium and its (+) alloys have an elastic modulus (100-120 GPa) a much smaller than stainless steel (210 GPa), it is still significantly higher than that of bone tissue.

Unit

The unit of Young's modulus is the pascal.

1 pascal = 1Pa = 1 Newton per square meter = $1N/M^2 = 1.450377\times10^{-4}$ psi

where psi = pounds per square inch. Please see http://en.wikipedia.org/wiki/Pressure#Units

Please note that Young's modulus has the same units as pressure because strain = Delta L /L is a dimensionless quantity.

Calculation

Like what we said that Young's modulus describes how much a material will stretch when put under a given stress. And the calculation of the Young's modulus of a sample of material is therefore: Young's modulus = stress / strain we can see that Young’s modulus its very important not just for the physical but also for the doctor because we are using in our body it to know many thing about the muscle and the bone and the tissue