زبان تخصصی مهندسی مکانیک

قسمت سوم

فصل سوم : مفاهیم پایه مکانیک

۳-۱-۱- مفهوم تنش (Concept of Stress)

۳-۱-۱-۱- مقدمه (INTRODUCTION)

The main objective of the study of the mechanics of materials is to provide the future engineer with the means of analyzing and designing various machines and load-bearing structures.

Both the analysis and the design of a given structure involve the determination of stresses and deformations. This chapter is devoted to the concept of stress.

معنی	کلمه	معنی	کلمه
هدف	objective	سازه	structure
اصلی	main	شامل	involve
فراهم کردن	provide	تعیین	determination
متنوع	various	تغییر شکل	deformation
تحمل کردن	bear		

۳-۱-۲- تنش در اعضای یک سازه (STRESSES IN THE MEMBERS OF A STRUCTURE)

While the results (which are) obtained in the preceding section represent a first and necessary step in the analysis of the given structure, they do not tell us whether the given load can be safely supported. Whether rod *BC*, for example, will break or not under this loading depends not only upon the value (what is) found for the internal force F_{BC}, but also upon the cross-sectional area of the rod and the material of which the rod is made. Indeed, the internal force F_{BC} actually represents the resultant of elementary forces (which are) distributed over the entire area A of the cross section (*Figure* $-3-1$) and the average intensity of these distributed forces is equal to the force per unit area $\dfrac{F_{BC}}{A}$ in the section.

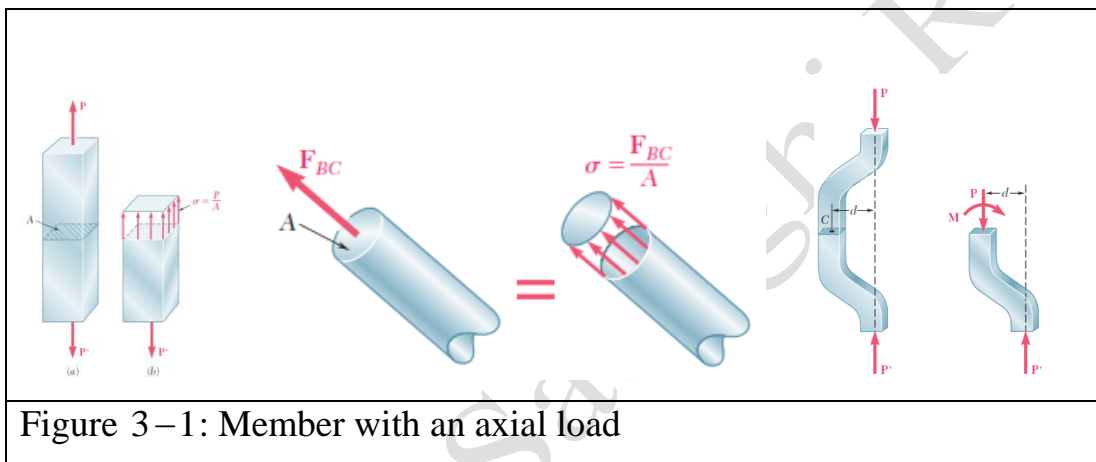| معنی	کلمه	معنی	کلمه
پیش رو	preceding	ارائه دادن	represent
میله(سطح گرد)	rod	بستگی داشتن	depends
میله(سطح دلخواه)	bar	سطح مقطع	Cross-sectional
در واقع	indeed	بطور واقعی	actually
برآیند	resultant	اصلی، بنیادی	elementary
شدت	intensity	توزیع کردن	distribute

Figure $3-1$: Member with an axial load

Whether or not the rod will break under the given loading clearly depends upon the ability of the material to withstand the corresponding value $\frac{F_{BC}}{A}$ of the intensity of the distributed internal forces. It thus depends upon the force F_{BC}, the cross-sectional area A, and the material of the rod.

The force per unit area, or intensity of the forces distributed over a given section, is called the stress on that section and is denoted by the Greek letter σ (sigma). The stress in a member of cross-sectional area A subjected to an axial load P $(Figure-3-1)$ is therefore obtained by dividing the magnitude P of the load by the area A:

$$\sigma = \frac{P}{A}$$

A positive sign will be used to indicate a tensile stress (member in tension) and a negative sign to indicate a compressive stress (member in compression).

معنی	کلمه	معنی	کلمه
واضح	clearly	توانایی	ability
مقاومت کردن	withstand	بنابراین	thus
نشان دادن	denote	(قرار گرفته) تحت	subjected to
تقسیم کردن	divide	مقدار	magnitude
نشان دادن	indicate	کششی	tensile

Since SI metric units are used in this discussion, with *P* expressed in newtons *(N)* and *A* in square meters (m^2) , the stress σ will be expressed in N/m^2 .

This unit is called a pascal (*Pa*). However, one finds that the pascal is an exceedingly small quantity and that, in practice, multiples of this unit must be used, namely, the kilopascal (*KPa*), the mega pascal (*MPa*), and the giga pascal (*GPa*).

We have:

$$1KPa = 10^3 Pa = 10^3 \, N/m^2$$

$$1MPa = 10^6 Pa = 10^6 \, N/m^2$$

$$1GPa = 10^9 Pa = 10^9 \, N/m^2$$

When U.S. customary units are used, the force P is usually expressed in pounds (*lb*) or kilopounds (*kip*), and the cross-sectional area *A* in square inches (in^2) . The stress σ will then be expressed in pounds per square inch (*psi*) or kilo pounds per square inch (*ksi*).

معنی	کلمه	معنی	کلمه
از آنجایی که	Since	مبحث	discussion

بیان کردن	express	به توان دو	square
به شدت	exceedingly	کمیت	quantity
ضرب کردن	multiple	مرسوم	customary

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