زبان تخصصی مهندسی مکانیک

قسمت يازدهم

At this point, an important property of circular shafts should be noted: When a circular shaft is subjected to torsion, every cross section remains plane and undistorted. In other words, while the various cross sections along the shaft rotate through different amounts, each cross section rotates as a solid rigid slab. This is illustrated in Figure, which shows the deformations in a rubber model subjected to torsion. The property we are discussing is characteristic of circular shafts, whether solid or hollow; it is not enjoyed by members of noncircular cross section. For example, when a bar of square cross section is subjected to torsion, its various cross sections warp and do not remain plane

معنى	کلمه	معنى	كلمه
توضيح دادن،نشان دادن (باشكل)	illustrate	لاستيكى	rubber
بحث كردن	discuss	دارا بودن	enjoy
اعواج داشتن، تاب برداشتن	warp		



The cross sections of a circular shaft remain plane and undistorted because a circular shaft is axisymmetric, i.e., its appearance remains the same when it is viewed from a fixed position and rotated about its axis through an arbitrary angle. (Square bars, on the other hand, retain the same appearance only if they are rotated through) As we will see presently, the axisymmetry of circular shafts may be used to prove theoretically that their cross sections remain plane and undistorted.

معنى	کلمه	معنى	کلمه
متقارن	symmetric	ظاهر	appearance
متقارن محوري	axisymmetric	دلخواه	arbitrary
نگه داشتن	retain	ثابت کردن	prove
به صورت تئوری	theoretically		

Consider the points C and D located on the circumference of a given cross section of the shaft, and let C' and D' be the positions they will occupy after the shaft has been twisted. The axisymmetry of the shaft and of the loading requires that the rotation which would have brought D into D' should now bring C into C'.

Thus C' and D' must lie on the circumference of a circle, and the arc C'D' must be equal to the arc CD.

معنى	کلمه	معنى	کلمه
قرار دادن یا داشتن	locate	محيط	circumference
اشغال کردن، جا گرفتن	occupy	كمان	arc
آوردن	Brought(bring)		



ابراهیم صادقی راد

We will now examine whether the circle on which C' and D' lie is different from the original circle. Let us assume that C' and D' do lie on a different circle and that the new circle is located to the left of the original circle, as shown in Figure. The same situation will prevail for any other cross section, since all the cross sections of the shaft are subjected to the same internal torque T, and an observer looking at the shaft from its end A will conclude that the loading causes any given circle drawn on the shaft to move away. But an observer located at B, to whom the given loading looks the same (a clockwise couple in the foreground and a counter clockwise couple in the background) will reach the opposite conclusion, i.e., that the circle moves toward him. This contradiction proves that our assumption is wrong and that C' and D' lie on the same circle as C and D. Thus, as the shaft is twisted, the original circle just rotates in its own plane. Since the same reasoning may be applied to any smaller, concentric circle located in the cross section under consideration, we conclude that the entire cross section remains plane.

معنى	کلمه	معنى	كلمه
بررسی کردن	examine	اصلى	original
مكان، موقعيت	situation	غالب بودن	prevail
ناظر	observer	کشیدن	Drawn(Draw)
پیش زمینه	foreground	تناقض	contradiction
فرضيه	assumption	هم مرکز	concentric
تمام، كامل	entire	<i>v</i>	



The above argument does not preclude the possibility for the various concentric circles of Figure to rotate by different amounts when the shaft is twisted. But if that were so, a given diameter of the cross section would be distorted into a curve which might look as shown in Figure. An observer looking at this curve from A would conclude that the outer layers of the shaft get more twisted than the inner ones, while an observer looking from B would reach the opposite conclusion.

This inconsistency leads us to conclude that any diameter of a given cross section remains straight and, therefore, that any given cross section of a circular shaft remains plane and undistorted.

معنى	كلمه	معنى	کلمه
بحث	argument	مانع شدن، جلوگیری کردن	preclude
لايه	layer	تناقض	inconsistency
مستقيم	straight		

