

# New Analysis Based on Unit Body Balance and Its Particle Balance Problem - The Basic Contradiction and New Analysis of Current Elasticity Theory

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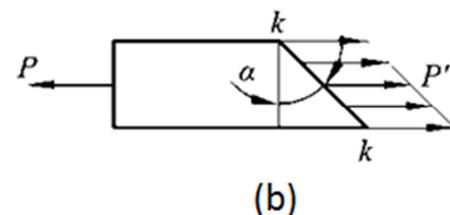
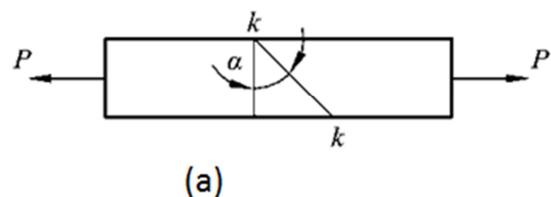
**Abstract:** This paper discovered a new concept that the unit balance and particle balance are not equivalent. Based on the research of tensile of uniform section bar, it indicated that the normal stress  $\sigma_\alpha$  and shear stress  $\tau_\alpha$  on oblique section can only make sure partly body balance while not every particles. The value of  $\sigma_\alpha$  and  $\tau_\alpha$  is less than the equilibrium stress of particles. Besides, the particle balance stress is  $\sqrt{2}$  times of the unit balance stress in the state of pure extension. The extreme stress is not the principal stress of cell body but the balance stress of particle. Using this formula, the problem existed for 350 years that the stretch-shear act on a bar is easier destroyed relate to the compress-shear acted can be explained perfectly. What's more, this theory has also been validated in the Damage Mechanics National Key Laboratory of Tsinghua University. The error between this theory and actual is only 1%, while based on three and fourth strength theory, the errors are 14.2%, 18.2% respectively. It's also the root cause of large bridge collapse.

**Keywords:** Unit Body Balance, Particle Balance, Stress, Strength Theory

## 1. Equal Straight Rod Tension Body Oblique Section of Particles Cannot Balance the Contradiction

### 1.1. Straight Rod Tension on Inclined Plane [1] of Arbitrary Point don't Balance

And straight rod tension [1] as shown in figure 1 (a) shows, as is known to all, Rod any dot are subject to equal and direction opposite to the tensile stress state of equilibrium, and the current theory of elasticity will make in the bar particle can't be in equilibrium.



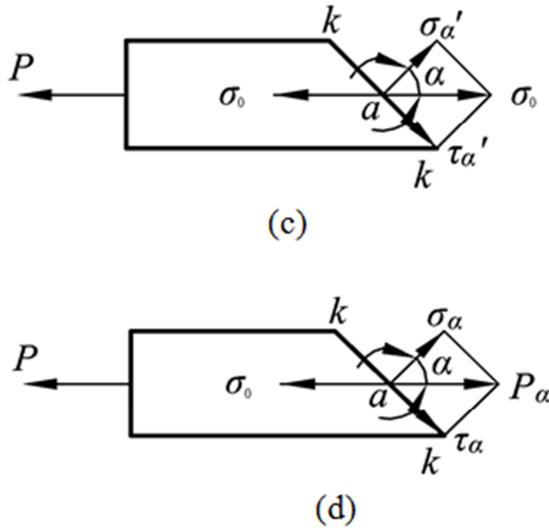


Figure 1. Straight rod tension.

Set a rod axial direction tension for  $F$ , cross section area of  $A$  inclined plane  $k - k$  (and vertical direction Angle for  $\alpha$ ) any point in the normal stress  $\sigma_\alpha$  and shear stress  $\tau_\alpha$ , The current theory of elasticity is derived as follows:

Cross section for the normal stress  $\sigma_0$ :

$$\sigma_0 = \frac{F}{A} \tag{1}$$

And cross section into  $\alpha$  Angle inclined plane  $k - k$  area of  $A_\alpha$ , the relationship between  $A$  and  $A_\alpha$  is:

$$A_\alpha = \frac{A}{\cos \alpha} \tag{2}$$

Use  $F_\alpha$  said  $k - k$  on the internal force of horizontal direction, the unit body left period of balance [figure 1 (b)] available  $F=F_\alpha$ . Due to internal force is evenly distributed, the inclined plane  $k - k$  for the stress  $P_\alpha = \frac{F_\alpha}{A_\alpha} = \frac{F}{A}$ , Will type (2) generation into the type available

$$P_\alpha = \frac{F}{A} \cos \alpha = \sigma_0 \cos \alpha \tag{3}$$

Put  $P_\alpha$  down into perpendicular to the inclined plane of the normal stress [2]  $\sigma_\alpha$  and shear stress  $\tau_\alpha$  in angent to the cross-section of shear stress  $\tau_\alpha$ , as shown in figure 1 (c) shows. Is

$$\sigma_\alpha = P_\alpha \cos \alpha = \sigma_0 \cos^2 \alpha \tag{4}$$

$$\tau_\alpha = P_\alpha \sin \alpha = \sigma_0 \cos \alpha \sin \alpha = \frac{\sigma_0}{2} \sin 2\alpha \tag{5}$$

Note: type (4) with type (5) just keep left section bar balance of normal stress and shear stress, it is not keep in the cross section  $k - k$  any point balanced of stress. This point can get clear proof: figure 1 (c) take a point, the particle is a three stress, namely,  $\sigma_0$  and  $\tau_\alpha$ , and,  $\sigma_\alpha$  and  $\tau_\alpha$  synthetic stress for

$$P_\alpha = \sqrt{\sigma_\alpha^2 + \tau_\alpha^2} = \sqrt{(\sigma_0 \cos^2 \alpha)^2 + (\sigma_0 \cos \alpha \sin \alpha)^2} = \sigma_0 \cos \alpha$$

. And particle a left by the stress  $\sigma_0$ , visible around stress are not equal, namely  $\sigma_0 \neq \sigma_0 \cos \alpha$ , over the type shove that particle a is in not equilibrium state, this is not conform to reality [3-4]. Min Zhang [5] and others discussed the equilibrium conditions of the particle system with time-varying constraints. Hongfen Nian [6] and others used the non-zero moment elastic theory to derive the new formula of the critical force of the compression bar under the moment theory, and demonstrated the unsafeness of the current Euler pressure bar stability critical formula.

### 1.2. Keep Equal Straight Rod Tensile Body Oblique Section of Particles on Balance of Normal Stress and Shear Stress

To ensure that inclined plane  $k - k$  any particle a balance, must make,  $\sigma_{0left} = \sigma_{0right}$  as shown in figure 1 (d) shows. This is very obvious conclusion: equal straight rod unidirectional tensile body any a point by measurement equal and direction opposite stress and in a state of equilibrium. A point not because artificially crossed a  $k - k$  slash (considered section  $k - k$  online point) and is in a state not of equilibrium. Inclined plane  $k - k$  on the point to balance must be force obtained analytical method, namely

$$\sigma'_\alpha = \sigma_0 \cos \alpha \tag{6}$$

$$\tau'_\alpha = \sigma_0 \sin \alpha \tag{7}$$

Type (6) type (7) to ensure tensile body any cross section on particle balance stress, because

$$\sigma_{0right} = \sqrt{(\sigma'_\alpha)^2 + (\tau'_\alpha)^2} = \sqrt{(\sigma_0 \cos \alpha)^2 + (\sigma_0 \sin \alpha)^2} = \sigma_{0left}$$

explain particle a left and right be measurement equal and in the opposite direction stress and be in balance. Therefore, type (4) type (5) is the calculation keep particle balance stress formula.

### 1.3. New Analysis of Unit Body Balance and Particle Balance

(1) unit body balance and particle balance is the essential difference. The body of the cell is the balance no matter element obtain how tiny, want to consider the force the area of size, can only use stress by area use force to balance, can't use stress to balance. And particle, according to the mathematical definition: particle no size, therefore, particle balance no area of the request, it can be directly use stress to balance. If consider area, also is any direction of the area are equal, may disappear in the balance equation.

(2) With differential balanced get inclined plane stress, even if when the differential Infinitesimal, the stress is not equal to the the differential body neighborhood particle equilibrium stress.

(3) the current theory of elasticity with micro regular hexahedron do mechanics model, and get the parties upward stress. The stress is still micro element balance stress, not three direction stress state of the particle balance stress.

(4) role in each area element of the stress are no-converging system of forces, when the element approach in particle, acting on the particle on the force will become converging force system, resolve rule ask before they can force their Heli

(5) Since the cross section is arbitrarily taken, that is, the angle  $\alpha$  is  $+90^\circ$  to  $-90^\circ$  from the surface, indicating that all the particles on the balance body are in imbalance.

## 2. Pure Shear Stress State of the Particle Balance Stress

### 2.1. Pure Shear Stress State on the Inclined Plane Stress Is not Particle Balance Stress

For the two direction stress state on any oblique plane stress formula [7]

$$\sigma_\alpha = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\alpha - \tau_x \sin 2\alpha \quad (8)$$

Can be obtained pure shear stress state diagonal  $ac$  inclined plane normal stress  $\sigma_{bd}$  and  $bd$  inclined plane normal stress  $\sigma_{ac}$ , as shown in figure 2 shows. At this time  $\sigma_x = \sigma_y = 0$ ,  $\alpha = \pm 45^\circ$ . Substituting type (8), available  $\sigma_{bd} = -\tau$ ,  $\sigma_{ac} = \tau$ . Description on the diagonal  $ac$  each point are subject to tensile stress, the diagonal  $bd$  each pointson by pressure stress. Research in figure 2 a point of balance, acting on a point there are three stress:  $\tau$ ,  $\tau$ , and  $\sigma_\alpha$ . For particle terms, there is no concept of area. therefore, static equilibrium equation can be directly with stress and not force representation, namely

$$\begin{aligned} \sum x &= \tau - \sigma_a \cos 45^\circ \\ &= \tau - \frac{\sqrt{2}}{2} \tau = \left(1 - \frac{\sqrt{2}}{2}\right) \tau \neq 0 \end{aligned}$$

$$\begin{aligned} \sum y &= \tau - \sigma_a \cos 45^\circ \\ &= \tau - \frac{\sqrt{2}}{2} \tau = \left(1 - \frac{\sqrt{2}}{2}\right) \tau \neq 0 \end{aligned}$$

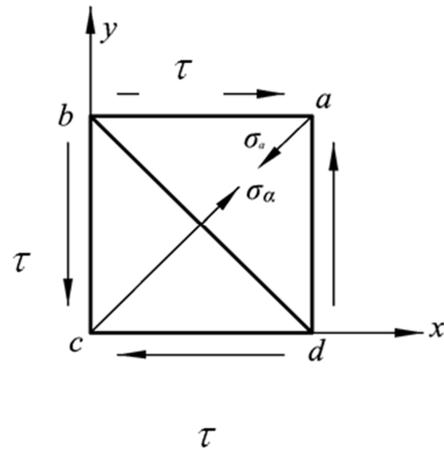


Figure 2. Stress on the slope of pure shear stress state.

This shows that pure shear stress state, the formula (8) values of stress can't keep its balance of any particle. That is not to maintain the balance of particle balance stress.

### 2.2. Inside Pure Shear Stress State Body Any Particle Balance Stress

Pure shear stress state as shown in figure 3 (a), as shown on the research of the a and b, c, d each particle balance. A point is the original mutually perpendicular two shear stress effect, the resultant composition of force for

$$\sigma'_a = \sqrt{\tau^2 + \tau^2} = \sqrt{2}\tau \quad (9)$$

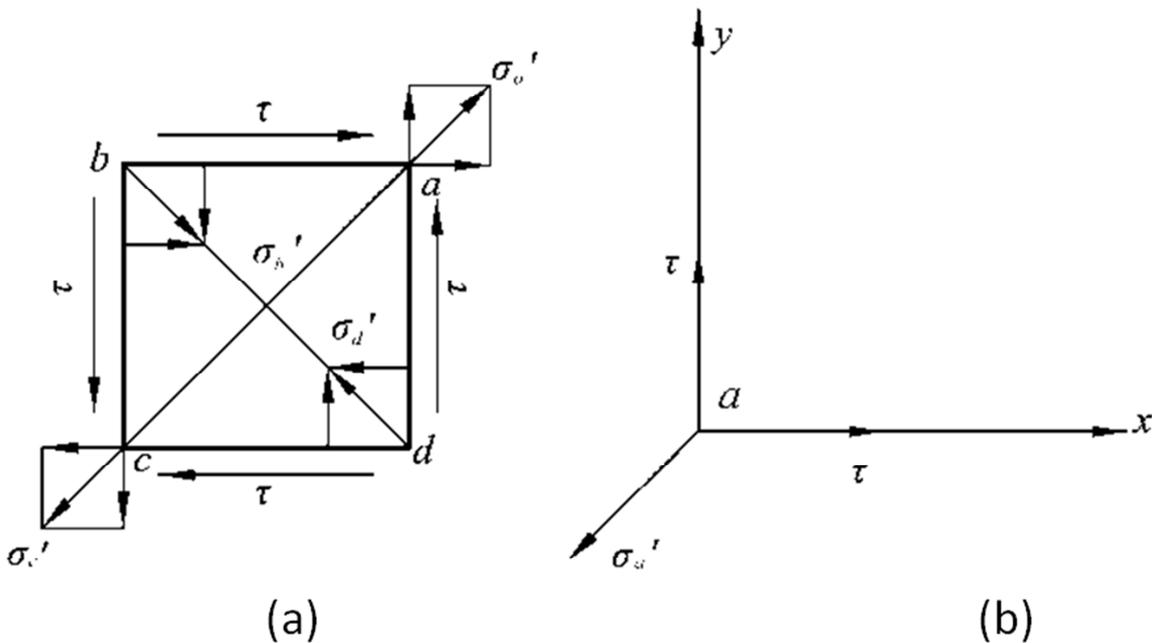


Figure 3. Balance stress in any mass point in pure shear stress state.

$\sigma'_a$  is to keep the particle balance of particle balance stress, similarly may ask the other point of balance stress

$\sigma'_b = \sigma'_c = \sigma'_d = \sigma'_a = \sqrt{2}\tau$  Study a point of balance, as shown in figure 3 (b), as shown by the balance equation can get

$$\sum x = \tau - \sigma'_a \cos 45^\circ = \tau - \sqrt{2}\tau \cdot \frac{\sqrt{2}}{2} = 0, \sum y = \tau - \sigma'_a \cos 45^\circ = \tau - \sqrt{2}\tau \cdot \frac{\sqrt{2}}{2} = 0.$$

Visible particle A in equilibrium state and similarly can ask the other point also equilibrium state. Type (9) for pure shear stress state of the particle balance stress.

From the current principal stress formula [8]

$$\left. \begin{matrix} \sigma_1 = \sigma_{\max} \\ \sigma_2 = \sigma_{\min} \end{matrix} \right\} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_x^2} \quad (10)$$

available

$$\left. \begin{matrix} \sigma_{\max} \\ \sigma_{\min} \end{matrix} \right\} = \pm \tau_x \quad (11)$$

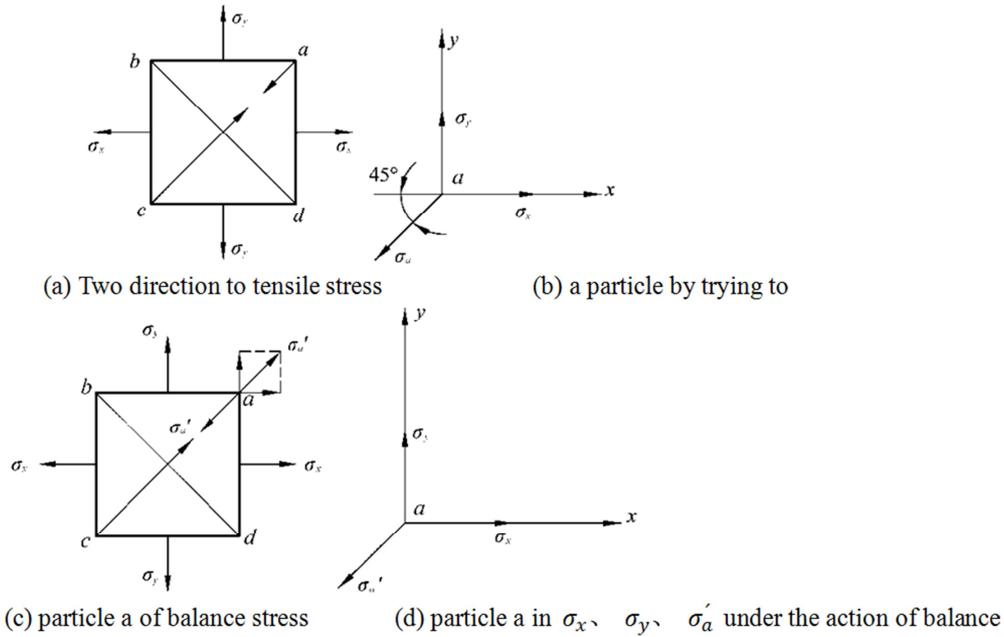


Figure 4. Particle equilibrium stress under two-dimensional pure tensile stress.

Study a point of balance: a point force as shown in figure 4 (b) shows. Due to the particle of the balance equation can be used stress instead of force calculation, accordingly, its balance equation for:

$$\sum x = \sigma_x - \sigma_{ac} \cos 45^\circ = \sigma - \frac{\sqrt{2}}{2} \sigma = \left(1 - \frac{\sqrt{2}}{2}\right) \sigma \neq 0$$

$$\sum y = \sigma_y - \sigma_{ac} \cos 45^\circ = \sigma - \frac{\sqrt{2}}{2} \sigma = \left(1 - \frac{\sqrt{2}}{2}\right) \sigma \neq 0$$

The above two type, it is known that a point is in not equilibrium state,  $\sigma_{ac}$  not on its particle balance stress.

Contrast type (11) and type (9) get: the maximum principal stress is not extremum stress, particle balance stress is the particle is the extremum stress.

### 3. Two Direction to Pure Tensile Stress State of the Particle Balance Stress

#### 3.1. Oblique Section of Point Can't Be in Equilibrium State

Two direction to tensile stress state as shown in figure 4 (a) shows, diagonal ac by on the stress, the two direction stress state for arbitrary on the any cross section stress formula [9] is

$$\text{obtained } \sigma_\alpha = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\alpha - \tau_x \sin 2\alpha$$

Diagonal ac of normal stress  $\sigma_{ac}$ , bd and x axis Angle to  $45^\circ$ , again will  $\tau_x = 0$  generation into above the type available  $\sigma_{ac} = \frac{\sigma_x + \sigma_y}{2}$ . If  $\sigma_x = \sigma_y = \sigma$ , then  $\sigma_{ac} = \sigma$ . Visible diagonal ac on each the particle are to tensile stress.

#### 3.2. Particle Balance Stress

Particle a balance stress as shown in figure 4 (c), as shown by stress  $\sigma_x$  and  $\sigma_y$  composition of force for

$$\sigma'_a = \sqrt{\sigma_x^2 + \sigma_y^2} \quad (12)$$

When  $\sigma_x = \sigma_y = \sigma$ ,  $\sigma'_a = \sqrt{2}\sigma$ ,  $\sigma_a$  and x axis angle for  $\alpha = 45^\circ$ . Diagonal ac on each point by tensile stress  $\sigma'_a$ . Study of particle a,  $\sigma_x$ ,  $\sigma_y$  and  $\sigma'_a$  under the action of balance, as shown in figure 4 (d) shows. Particle balance equation for.

$$\sum x = \sigma_x - \sigma'_a \cos \alpha = \sigma - \sqrt{2}\sigma \cos 45^\circ = 0$$

$$\sum y = \sigma_y - \sigma'_a \cos(90^\circ - \alpha) = \sigma - \sigma'_a \sin \alpha = \sigma - \sqrt{2}\sigma \sin 45^\circ = 0$$

Because  $\sigma'_a = \sqrt{\sigma_x^2 + \sigma_y^2}$  can guarantee a point of balance, is particle balance stress. Therefore, two direction equal as tensile stress of the particle balance stress for

$$\sigma'_a = \sqrt{2}\sigma \tag{13}$$

By type (10) can get the maximum principal stress  $\sigma_{max} = \sigma_x = \sigma_y$ , and type (13) contrast get: particle balance stress is the maximum principal stress of The  $\sqrt{2}$  Times, particle balance stress is the extremum stress. Contrast type (11) and (13) seen: two direction equal stress state particle balance stress is it diagonal on the oblique section of stress The  $\sqrt{2}$  Times.

### 4. New Analysis of Particle Stress in Two-Dimensional Tensile and Shear Stress State

Figure 5 (a) shows the normal stress and shear stress under the joint action of two direction stress state [7]. Particle a forced as shown in figure 5 (b), as shown by the projection and the resultant together force for:

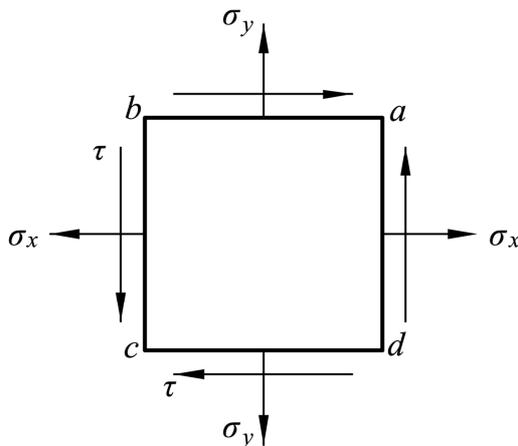
$$\sum x = \sigma_x + \tau$$

$$\sum y = \sigma_y + \tau$$

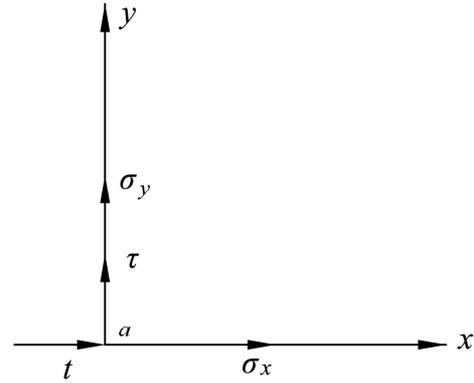
The particle balance stress for:

$$\sigma'_a = \sqrt{(\sum x)^2 + (\sum y)^2} = \sqrt{(\sigma_x + \tau)^2 + (\sigma_y + \tau)^2} \tag{14}$$

Type (14) is the two direction stress state of particle balance stress.



(a) two direction stress state



(b) a particle by trying to

Figure 5. Two-direction stress state.

When  $\sigma_x = \sigma_y = \sigma$ , there are:

$$\sigma'_a = \sqrt{2}(\sigma + \tau) \tag{15}$$

When  $\sigma_x = 0$ , the type (14), particle balance stress for:

$$\sigma'_a = \sqrt{(\sigma_x + \tau)^2 + \tau^2} = \sqrt{\sigma_x^2 + 2\sigma_x\tau + 2\tau^2} \tag{16}$$

Type (16) is tensile and shear combination of particle balance stress. Use particle balance stress establish strength conditions for

$$\sqrt{\sigma^2 + 2\sigma\tau + 2\tau^2} \leq [\sigma] \tag{17}$$

New strength formula (17) is different from the unit body with balance of the third and fourth strength theory formula [10].

$$\sqrt{\sigma^2 + 4\tau^2} \leq [\sigma] \tag{18}$$

$$\sqrt{\sigma^2 + 3\tau^2} \leq [\sigma] \tag{19}$$

Type (17), (18) and (19),  $[\sigma]$  for material allowable tensile stress. When there is no tensile stress,  $\sigma = 0$  is pure shear stress state, the type (17), (18) and (19) were simplified as:  $\sqrt{2}\tau \leq [\sigma]; 2\tau \leq [\sigma]; \sqrt{3}\tau \leq [\sigma]$ .

When the safety coefficient take 1, with the  $\sigma_s$  yield limit instead of  $[\sigma]$ , can find out yield shear stress  $\tau_s$  and the  $\sigma_s$  relationship between the yield limit

$$\tau'_s = \frac{\sqrt{2}}{2}\sigma_s = \sin 45^\circ \sigma_s \tag{20}$$

$$\tau_{s3} = \frac{1}{2}\sigma_s = \sin 30^\circ \sigma_s \tag{21}$$

$$\tau_{s4} = \frac{\sqrt{3}}{3}\sigma_s = \sin 35^\circ \sigma_s \tag{22}$$

Type (20), (21) and (22),  $\tau'_s$ ,  $\tau_{s3}$ ,  $\tau_{s4}$  respectively, said particle balance stress, the third strength theory, the fourth

strength theory of yield shear stress.

Above three type that yield tensile stress  $\sigma_s$  and the relationship between the yield shear stress  $\tau_s$ . Type (20) of the results and low carbon steel tensile experiment conclusion just the same. Tensile experiments show that low carbon steel tensile in  $45^\circ$  appear yield slip line, and type (21) with type (22) indicates that the low carbon steel tensile should in the  $30^\circ$  and  $35^\circ$  happen slip, but in fact is not the case. It proved that using particle balance stress be derived a combination of strength formula is the correctness of the (16).

For the brittle materials (such as cast iron) compression, the fracture surface and axis into  $45^\circ$  around the Angle, is the maximum shear stress of the damage, and the new formula calculated maximum shear stress occurs in  $45^\circ$  exactly the same; And third, fourth strength theory calculated maximum shear stress shall occur in the  $60^\circ$ ;  $55^\circ$ , but the experimental results is not so. Experimental results prove that the tensile stress that shear easier, compressive stress makes it difficult to shear. This kind of phenomenon with particle balance stress type (17) type can successfully explain: because type (17), tensile stress have a non square items  $2\tau\sigma$ ,  $\sigma$  for the  $\sigma'_a$  negative value for positive value  $\sigma$  is less than the  $\sigma'_a$ , namely

pressure stress makes it difficult to shear. And type (18) with type (19) in normal stress  $\sigma$  both tension or compression, the equivalent stress are equal, unable to explain this phenomenon. Mohr's strength theory can only be in tension and compression strength not equal of materials ranging from making this explanation, for tension and compression strength equal material can't reasonable explanation.

### 5. New Analysis of Particle Stress in Three-Dimensional Stress State

Elastic mechanics [11-12] with oblique section (ABC) Interception tiny cubes into regular triangle cone, as shown in figure 6 shows. By the balance of positive triangular pyramid, deduced oblique section (ABC) on the stress in the x, y, z axis of total stress component. Set the inclined section outside normal direction for n, the direction cosine for

$$\begin{aligned} \cos(n, x) &= l \\ \cos(n, y) &= m \\ \cos(n, z) &= n \end{aligned}$$

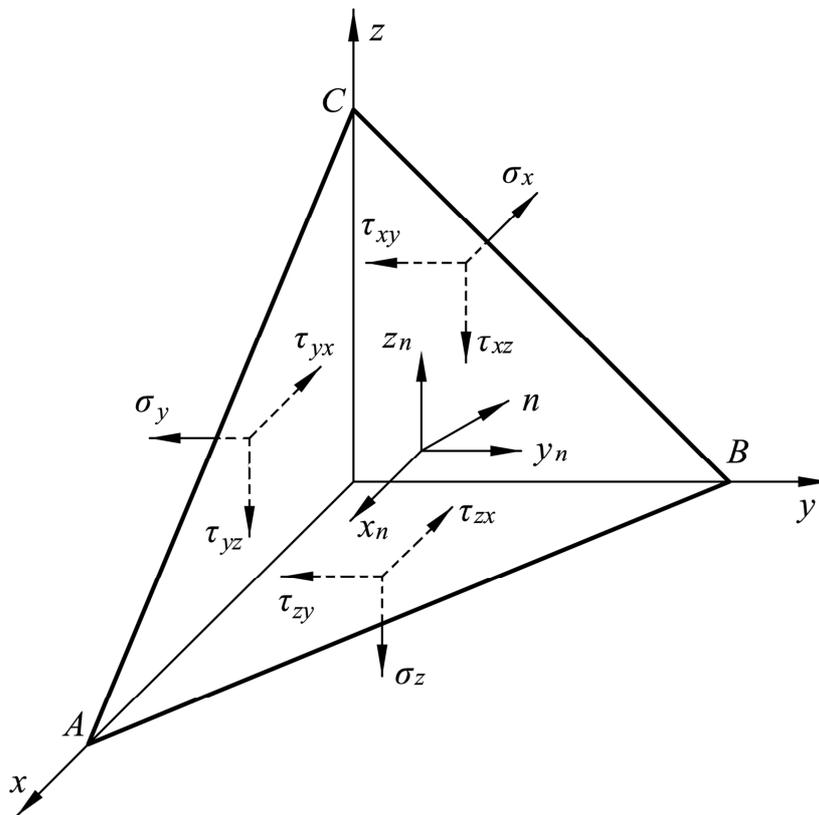


Figure 6. Particle balance under triaxial stress.

The oblique section (ABC) the total stress  $\sigma_a$  in the x, y, z shaft for projection

$$X_n = -(\tau_{yx}m + \tau_{zx}n + \sigma_x l) \tag{23}$$

$$Y_n = -(\tau_{xy}l + \tau_{zy}n + \sigma_y m) \tag{24}$$

$$Z_n = -(\tau_{xz}l + \tau_{yz}m + \sigma_z n) \tag{25}$$

Therefore, on the inclined section (ABC) for total stress  $\sigma_a$  for:

$$\sigma_\alpha = \sqrt{X_n^2 + Y_n^2 + Z_n^2} = \sqrt{(\tau_{yx}m + \tau_{zx}n + \sigma_x l)^2 + (\tau_{xy}l + \tau_{zy}n + \sigma_y m)^2 + (\tau_{xz}l + \tau_{yz}m + \sigma_z n)^2} \tag{26}$$

The new theory is that: here  $\sigma_\alpha$  is to keep three pyramid balanced on the bevel stress, it is not a plane (ABC) any particle balance stress. When this micro three pyramid approach endless, on the inclined section (ABC) point tends to M point, the M point stress is arbitrary point of balance stress.

Obviously, M point by the stress in the x, y, z axis for projection:

$$X_M = -(\tau_{yx} + \tau_{zx} + \sigma_x) \tag{27}$$

$$Y_M = -(\tau_{xy} + \tau_{zy} + \sigma_y) \tag{28}$$

$$Z_M = -(\tau_{xz} + \tau_{yz} + \sigma_z) \tag{29}$$

The M point total stress  $\sigma^*$  for:

$$\sigma^* = \sqrt{X_M^2 + Y_M^2 + Z_M^2} = \sqrt{(\tau_{yx} + \tau_{zx} + \sigma_x)^2 + (\tau_{xy} + \tau_{zy} + \sigma_y)^2 + (\tau_{xz} + \tau_{yz} + \sigma_z)^2} \tag{30}$$

In the type,  $\sigma^*$  is particle balance stress.

Contrast type (26) that type (30): keep truncated body balance on inclined plane stress and oblique section direction cosine relevant; And particle balance stress only and function stress related to the size of, and the direction cosine have nothing to do. Due to the direction cosine less than or equal to 1, therefore, oblique section on the total stress is less than the particle balance stress.

If shear stress are equal to zero, that is  $\tau_{yx} = \tau_{zx} = \tau_{xy} = \tau_{zy} = \tau_{yz} = \tau_{xz} = 0$ , the type (23); (24); (25) become:  $X_M = -\sigma_x$ ;  $Y_M = -\sigma_y$ ;  $Z_M = -\sigma_z$ .

The total stress

$$\sigma^* = \sqrt{\sigma_x^2 + \sigma_y^2 + \sigma_z^2} \tag{31}$$

Type (31) is only normal stress the role of three direction to the stress state of the particle balance stress.

If the micro is hexahedron coordinate take principal stress direction, set principal stress for  $\sigma_1$ 、 $\sigma_2$ 、 $\sigma_3$ , use the principal stress said the particles balance stress for:

$$\sigma^* = \sqrt{\sigma_1^2 + \sigma_2^2 + \sigma_3^2} \tag{32}$$

Particle balance stress  $\sigma^*$  and principal stress  $\sigma_1$ ,  $\sigma_2$ ,  $\sigma_3$ , the angle between the for:

$$\alpha_1 = \arctan \frac{\sqrt{\sigma_2^2 + \sigma_3^2}}{\sigma_1} \tag{33}$$

$$\alpha_2 = \arctan \frac{\sqrt{\sigma_1^2 + \sigma_3^2}}{\sigma_2} \tag{34}$$

$$\alpha_3 = \arctan \frac{\sqrt{\sigma_1^2 + \sigma_2^2}}{\sigma_3} \tag{35}$$

## 6. Solving the Defects and New Analysis of the Third and Fourth Strength Theories by Mass Balance Stress

The extensive use of the fourth strength theory, namely shape deformation energy criterion, the formula [13] for:

$$\sigma_{xd} = \sqrt{\frac{1}{2}[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2]} \leq [\sigma] \tag{36}$$

Type,  $\sigma_{xd}$  equivalent stress;  $[\sigma]$  for material allowable stress;  $\sigma_1$ 、 $\sigma_2$ 、 $\sigma_3$  and, as in unit body the principal stress, as shown in figure 7 shows. The concept of equivalent stress fuzzy, which are violate the force definition: force has size, direction and the working point three elements, but the effect of equivalent stress direction is not clear, and the force of three elements: the lack of direction element, has not said force. Force is vector, equivalent stress concept has the force into a scalar, shake the mechanics theory foundation, therefore, it is not reasonable.

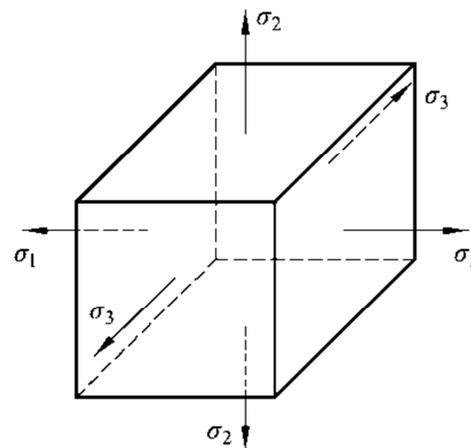


Figure 7. Inside unit body the main stress diagram.

By the elastic mechanics the derivation process of the known:  $\sigma_{xd}$  it means by the unit body is the deformation of the equivalent stress size. But,  $\sigma_{xd}$  not unit body tends to infinity hours particle by balance stress. By type (36), we can conclude that when principal stress  $\sigma_1 = \sigma_2 = \sigma_3$ , there are:

$$\sigma_{xd} = 0 \tag{37}$$

Type (37) by three direction equal tensile stress of the cube, no matter how normal stress  $\sigma$ , cube will not damage, the universe which have can withstand the infinite stress and not be destroyed material? This is obviously impossible. This shows that the fourth strength theory existence crisis. The third strength theory also existence crisis, its formula is  $d_{xd} = \sigma_1 - \sigma_3 \leq [\sigma]$ , when the  $\sigma_1 = \sigma_3$ ,  $d_{xd} = 0$ . Appear that the root cause of the crisis is the unit body on stress as particle by balance stress. Particle balance stress by type (32) sure, namely  $\sigma^* = \sqrt{\sigma_1^2 + \sigma_2^2 + \sigma_3^2}$ . When three direction to equal stress state,  $\sigma_1 = \sigma_2 = \sigma_3 = \sigma$ , and particle balance stress for:

$$\sigma^* = \sqrt{3}\sigma \neq 0 \tag{38}$$

Type (30) show that: by three perpendicular to each other direction equal of tensile stress of the cube no matter how much equal stress and tension will not be destroyed conclusion was overthrown, the particle balance stress is when simple tension stress of The  $\sqrt{3}$  Times, two completely opposite conclusion. Particle balance stress cracking conditions for  $\sigma^* = \sqrt{3}\sigma = \sigma_s$  namely:

$$\sigma = \frac{\sigma_s}{\sqrt{3}} = 0.58\sigma_s \tag{39}$$

Type (39) show that: by three to equivalent tensile stress state action, as long as the unidirectional tensile stress at 58% of the material yield limit will fracture. For the brittle materials (strength limit for  $\sigma_b$ ):

$$\sigma^* = 0.58\delta_b \tag{40}$$

When  $\sigma_3 = 0$ , for the plane stress state, and  $\sigma_1 = \sigma_2 = \sigma$ , stress theory formula (1.28) into:

$$\sigma_{xd} = \sqrt{\frac{1}{2}(0 + \sigma^2 + \sigma^2)} = \sigma \tag{41}$$

Type (41) show that by two direction cubes to equal stress state, and simple tension stress is exactly the same. The new concept elastic theory considers, two direction stress state particle by balance stress by formula (32) to determine, namely:

$$\sigma^* = \sqrt{2}\sigma \tag{42}$$

Fracture conditions for  $\sqrt{2}\sigma = \sigma_s$  namely:

$$\sigma = \frac{\sigma_s}{\sqrt{2}} = 0.71\sigma_s \tag{43}$$

Type (42) show that with two direction cubes to equal stress tensile, the body by tensile stress for simple tension of The  $\sqrt{2}$  Times. Type (43) show that the two direction way equal stress tensile, as long as to yield limit of 71%, appear fracture. This conclusion is two direction to equal stress tensile experiments confirmed. This conclusion was confirmed by the two-dimensional stress tensile failure test of the State Key

Laboratory of Destructive Mechanics of Tsinghua University. The experimental errors of the first, third, and fourth intensity theories are all 31%, while the experimental error of the new theory is only 2.3% [14].

## 7. In Conclusion

Prove the basic contradiction of the current elastic theory by demonstrating the equilibrium force of the particles under the conditions of pure shear stress, two-dimensional pure tensile stress, two-direction tensile and shear stress, and correct the current elastic theory. It is assumed that the moment (the limit of the moment acting on the unit area) is always zero to be non-zero. Analyze the defects of the third and fourth strength theories solved by the equilibrium stress of the particle and the new analysis based on the «theory of non-zero moment elasticity» [15].

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