

KES

General Rules for Fatigue Testing of Metals

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1. Scope of Application

This application shall be applied to the general principle of the fatigue test method of the metal material by the standard test edition in the real temperature air, and the subject shall be the average life span of fatigue over repeated 10^4 times.

2. Definition of Terminology

2.1 Definition of Terminology related to Stress and Repeated Number

2.1.1 Name Stress

Without considering the stress concentration by Notch or other conditions, elastically calculated stress. σ shall be marked as vertical stress and τ as shear stress.

2.1.2 Changeable Stress

Size changeable stress as time goes (Fig. 1)

2.1.3 Repeated Stress

Simply changeable stress in interval between a certain max and min (Fig. 2)

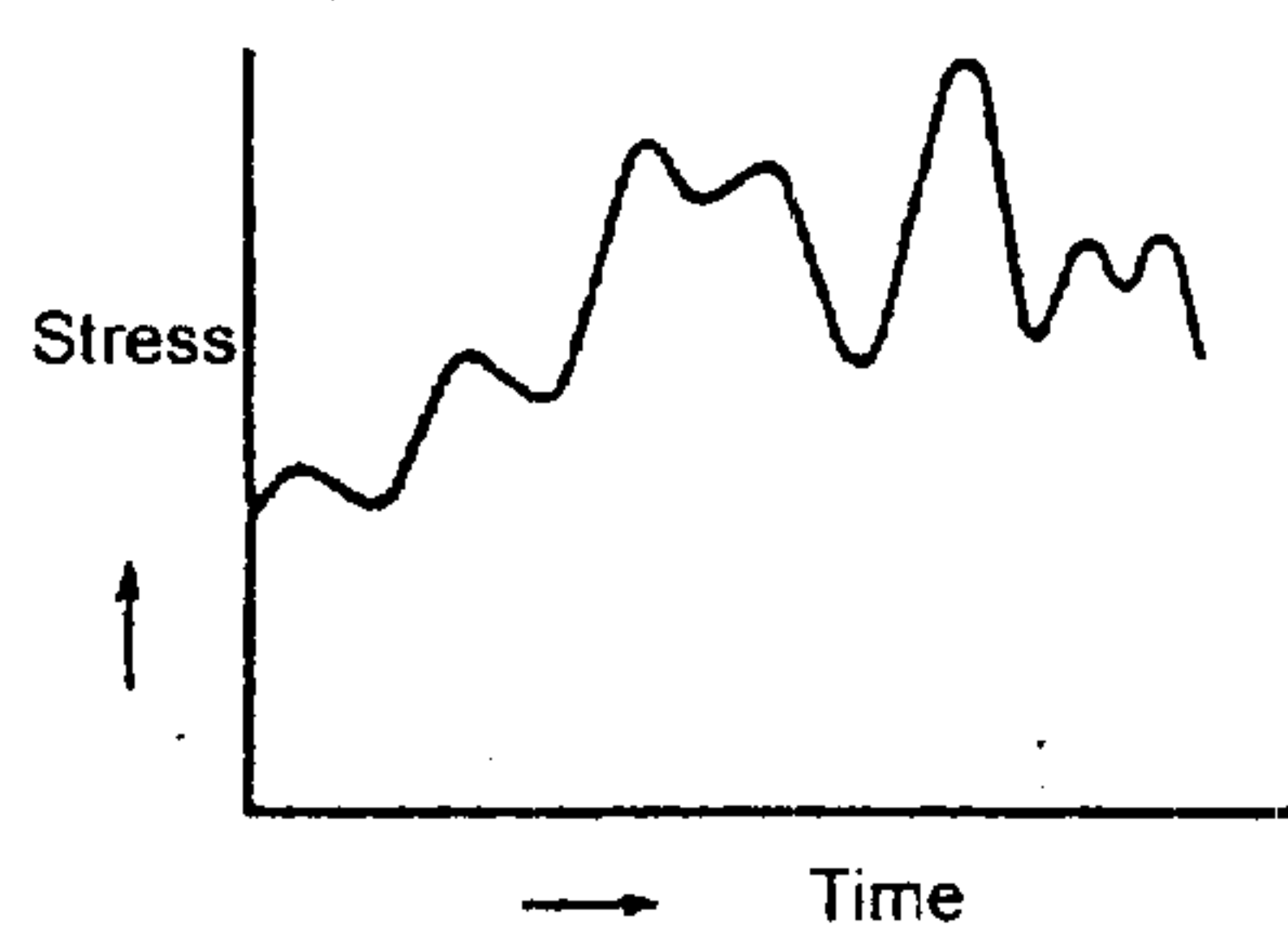


Figure 1 Changeable Stress

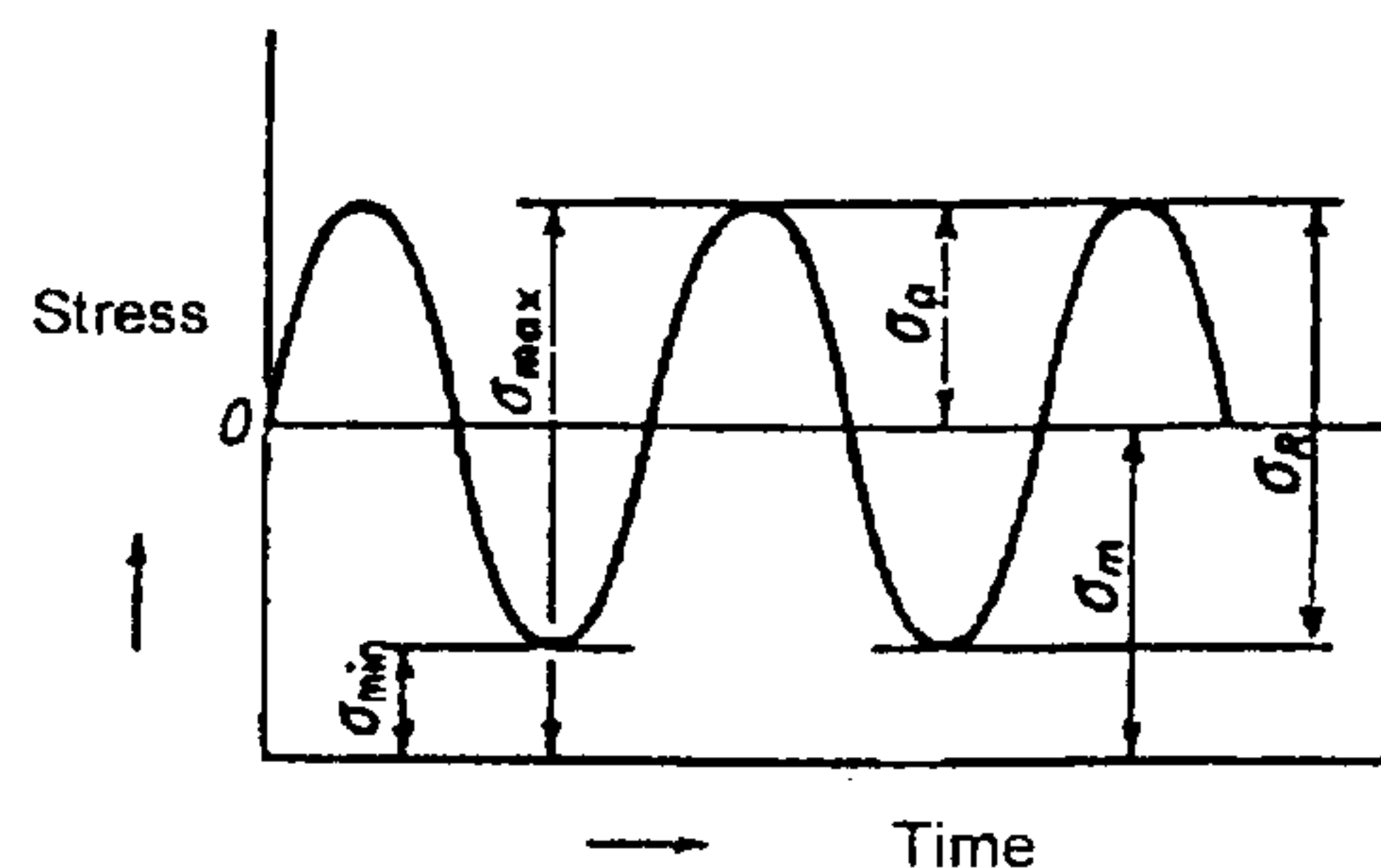


Figure 2 Repeated Stress

2.1.4 Max Stress $\sigma_{\max}$, $\tau_{\max}$

Algebraic max value of repeated stress (Fig. 2)

2.1.5 Min Stress $\sigma_{\min}$, $\tau_{\min}$

Algebraic min value of repeated stress (Fig. 2)

Remark : Record the max or min stress in consideration of mark, and in case of tension pressure, tension stress shall be +, pressed stress -. In case of shear stress, if the one side is set as +, the other side shall be -.

2.1.6 Average Stress σ_m , τ_m

1/2 of the sum of max stress and min stress of repeated stress (Fig. 2)

2.1.7 Amplitude of Stress σ_a , τ_a

1/2 of the remainder of max stress and min stress of repeated stress (Fig. 2)

2.1.8 Scope of Stress σ_R , τ_R

The remainder of max and min stress of repeated stress (Fig. 2)

2.1.9 Average Stress Rate of Amplitude A

The ratio of Amplitude of stress to average stress

$$A = \frac{\sigma_a}{\sigma_m} \quad \text{or} \quad A = \frac{\tau_a}{\tau_m}$$

2.1.10 Minimax Stress Rate R

The ratio of min stress to max stress

$$R = \frac{\sigma_{\min}}{\sigma_{\max}} \quad \text{or} \quad R = \frac{\tau_{\min}}{\tau_{\max}}$$

2.1.11 Both Side Stress

The stress back and forth between the max + and max –

(If $\sigma_m = 0$ or $\tau_m = 0$; see Fig. 3)

2.1.12 Partial Both Side Stress

The stress back and forth between the max + and max – which has different absolute value from each other

(If, $0 < |\sigma_m| < \sigma_a$ or $0 < |\tau_m| < \tau_a$; see Fig. 4)

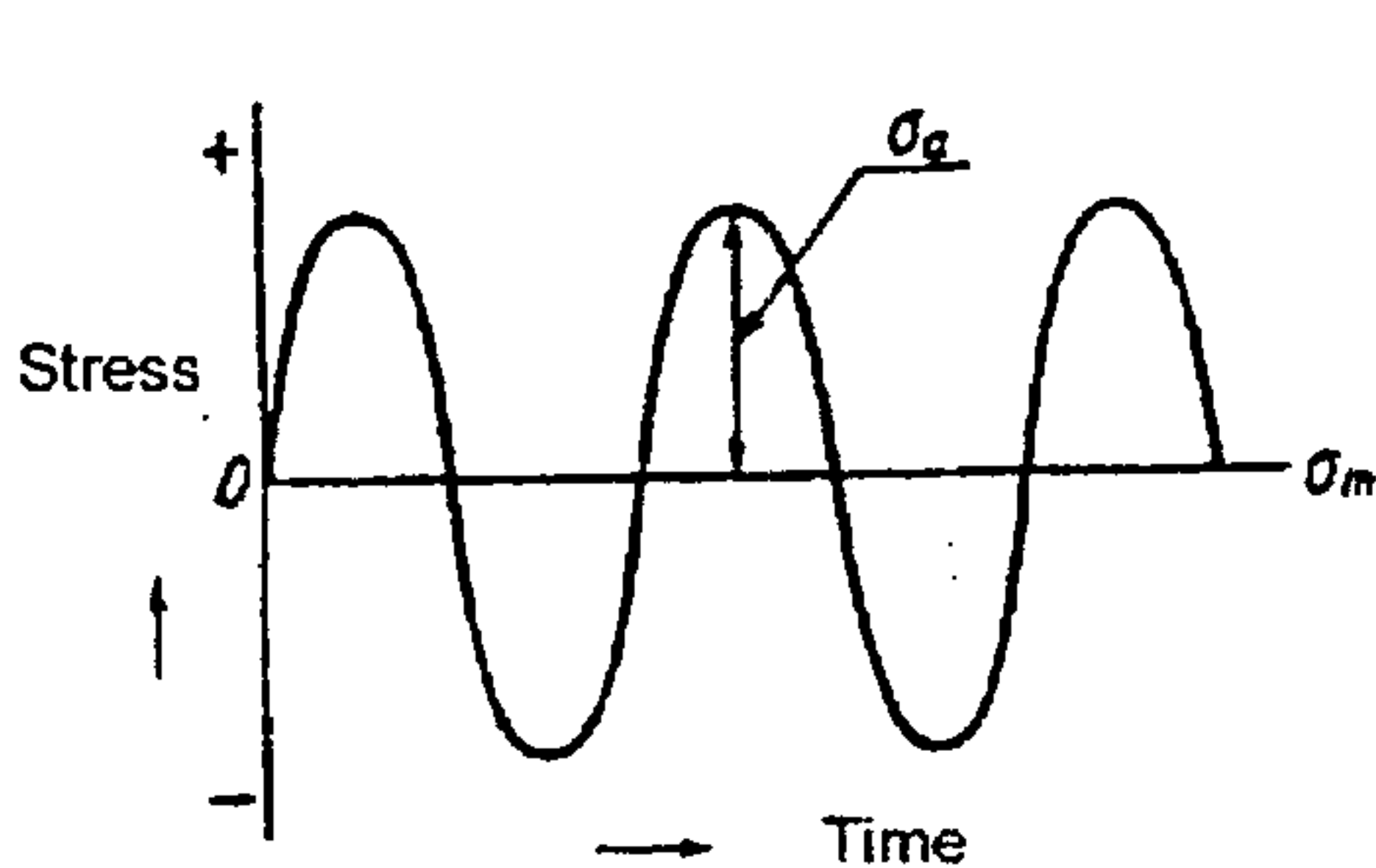


Figure 3. Both Forward Stress

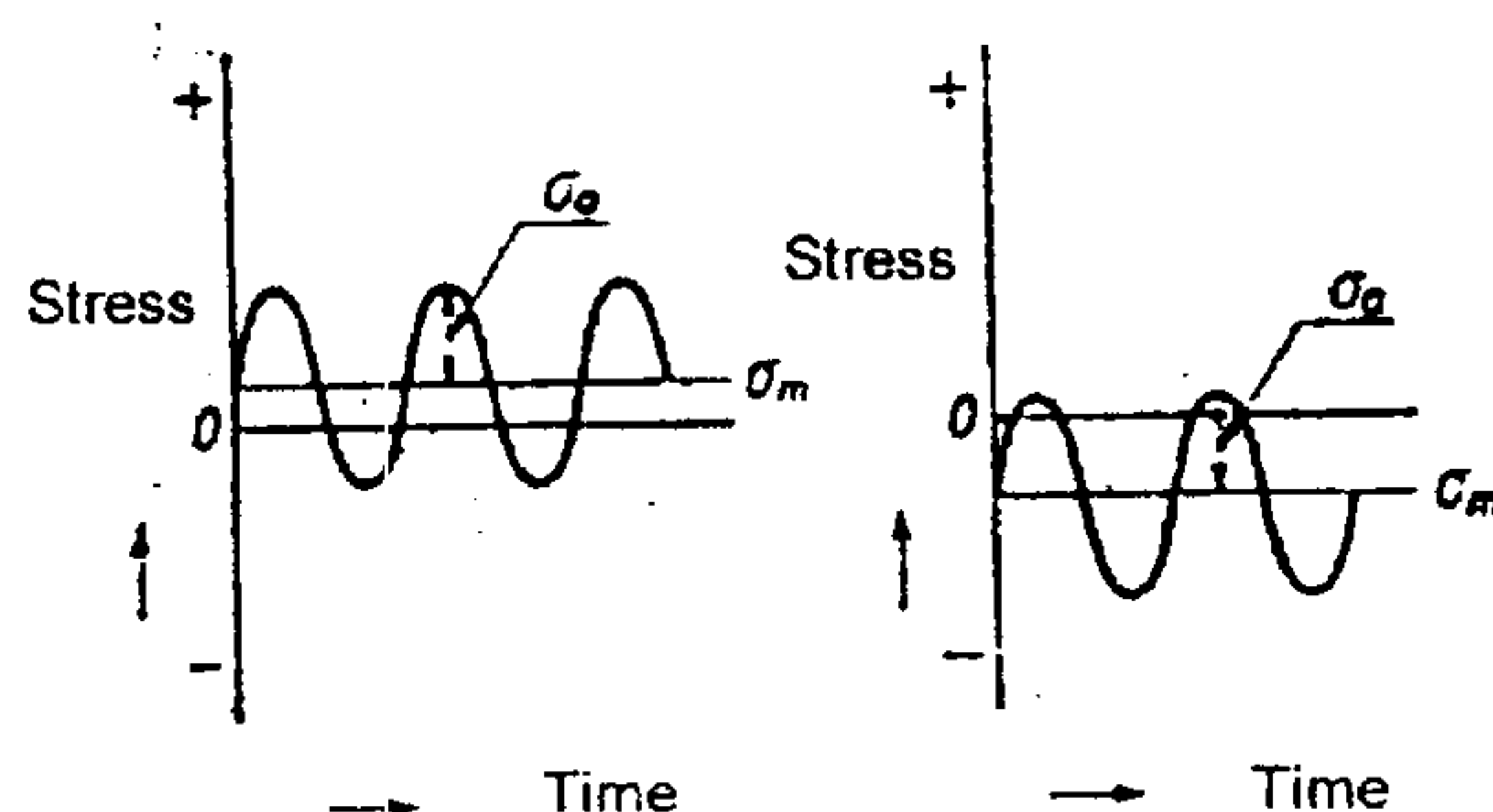


Figure 4. Partial Both Forward Stress

2.1.13 Single Side Stress

The Stress back and forth between 0 and max value, or 0 and min value

(If $\sigma_m = \sigma_a$ or $\tau_m = \tau_a$; see Fig. 5)

2.1.14 Partial Single Side Stress

The Stress back and forth between max and min value in the same mark

(If $\sigma_m > \sigma_a$ or $\tau_m > \tau_a$; see Fig. 6)

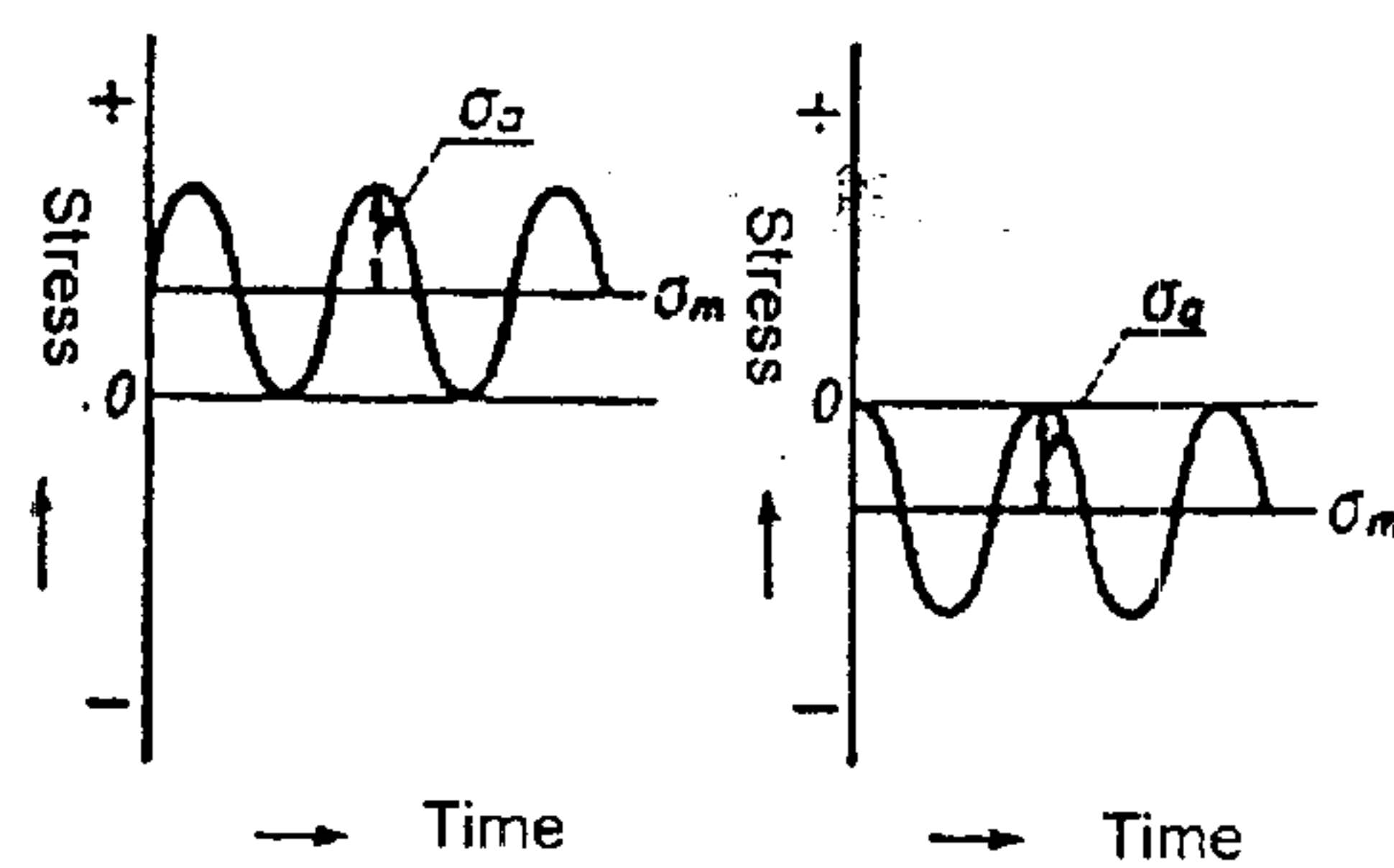


Fig. 5 Single Side Stress

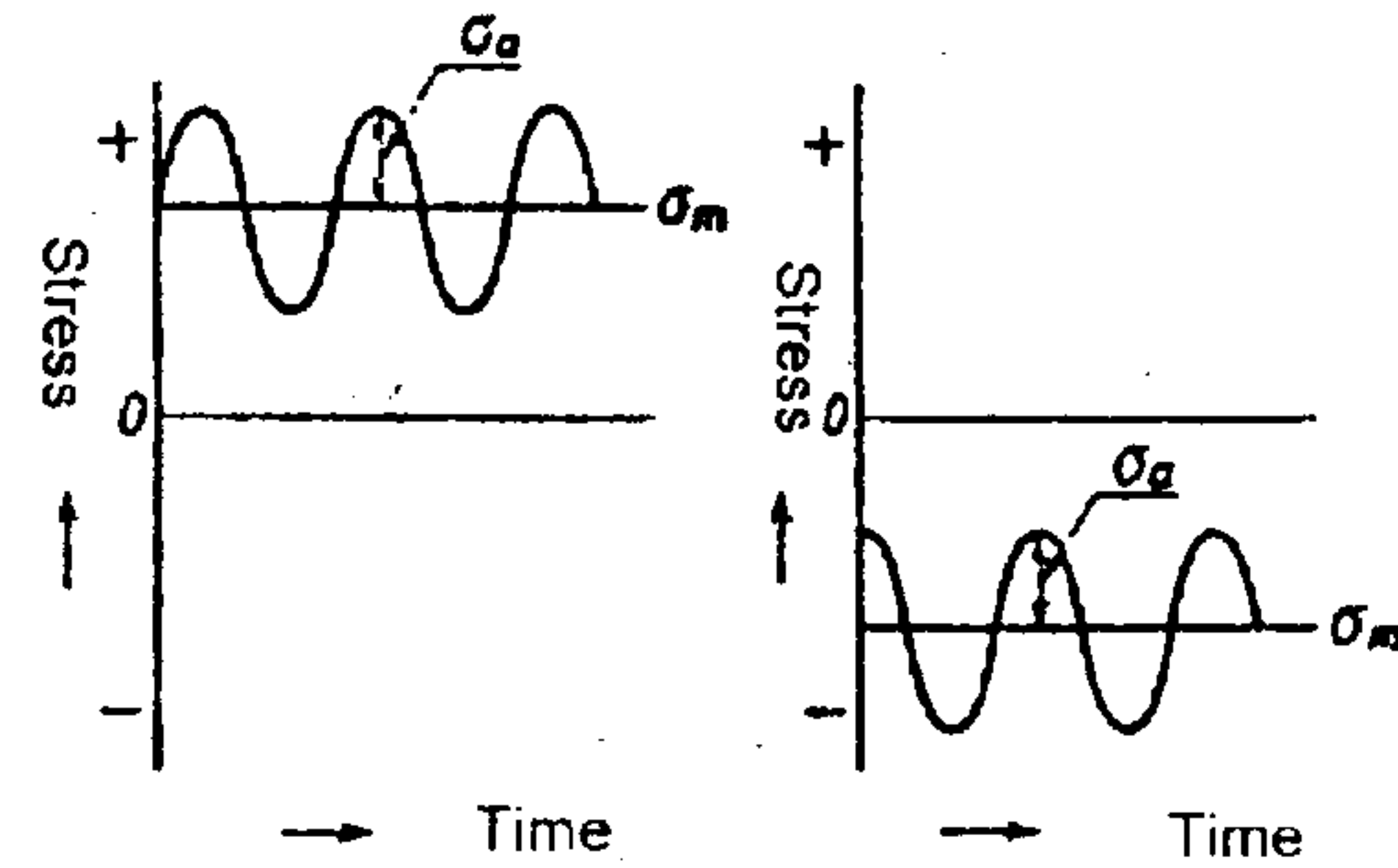


Fig. 6 Partial Single Side Stress

2.1.15 Repeated Number n

The repeated number of stress whose fatigue test is going on

2.1.16 Repeated Number N

The repeated time of stress until the fatigue is destroyed

2.1.17 Ratio of Repeated Number n/N

The ratio of repeated number n in the same stress condition to repeated number N until the destruction

2.1.18 Shape Coefficient α

When loading weight into the Notch test plate, the value of elastically calculated max stress divided by the name stress of that part

2.2 Terminologies Related to the Strength of Fatigue

2.2.1 S-N Line (Stress-Repeated Number Line)

The line describing as follow: Y =Stress, X =Repeated Number until the destruction (Including the repeated time in case of finishing the test without destruction)

2.2.2 Limitation of Fatigue

The max value of the stress bearing the unlimited repetition. By the sort of test, it is marked like 2.2.3 ~ 2.2.10

Remark : The meaning of these terminologies above is in the ideal case that the test value is not dispersed. Because the test value around the limitation of fatigue is usually dispersed, the limitation of fatigue is supposed to be set by the statistics.

2.2.3 Limitation of Both Side Seal-Pressed Fatigue σ_w

The limitation of fatigue when the both side seal-press is operated. It is marked as the stress amplitude

2.2.4 Limitation of Single Side Seal Fatigue σ_u

The limitation of fatigue when the single side seal press is operated. It is marked as