ASPECTS REGARDING THE DETERMINATION OF DYNAMIC COEFFICIENT

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Abstract: *The application by shock is linked to sudden changes of speed and acceleration of bodies,in collision situation. Shock problems can be reduced to problems of static requests by introducing the dynamic or static coefficient of impact between the dynamic and static stress.*

Key words: shock, dynamic stress, impact coefficient method.

1. INTRODUCTION

The stress by shock is linked to sudden changes of speed and acceleration of bodies. These situation occur when take place the collision bodies [1].If bodies colliding would be perfectly rigid final speed variation would occur instantly(Δt =0), which would mean infinitely large accelerations and inertial forces as large. In reality bodies are more or less deformable and speed variation is made instantly in a finite time, however, even if it is very small. Accelerations and inertia forces, havein shock real bodiescase finite values high. Because the law of variation during the short accelerations body collision points is very difficult to establish, D'Alembert's principle cannot be used in the study of shock. Therefore, it is almost always resort to solving the problems of shock approximate by using the law of conservation of energy. According to it admitted that the entire kinetic energy of the colliding bodies are transformed into potential energy of deformation [2].In technical shock usually occurs between a body at rest and a body in motion, one can consider that stops hit on the body moving.

The kinetic energy of a moving body is written,

$$E_c = \int_m \frac{1}{2}\mathrm{v}^2\mathrm{dm} \qquad (1)$$

v is the velocity of a component of mass dm.

For the translational movement of the kinetic energy is

$$E_c = \frac{1}{2}m\mathrm{v}^2 \qquad (2)$$

and for the rotation about an fixedaxis,

$$E_c = \frac{1}{2}I\omega^2 \qquad (3)$$

ω is the angular velocity and the moment of inertia I of the solid to the axis of rotation.For a G weight body falling from a height h, kinetic energy equal to the mechanical work (outside) made will be:

$$E_c = L_e = Gh \qquad (4)$$

Based on the energy conservation law can admit that the kinetic energy of the body turns off in potential energy of deformation of the two bodies:

$$E_c = W \text{ or } L_e = W \qquad (5)$$

2. Determination of dynamic shock stress using dynamic coefficient (coefficient of impact)

Collision of moving parts to another, at rest, in motion kinetic energy of the piece turns into potential energy of deformation of the hit workpiece [2].

Both tension and dynamic deformations of the piece required some force will be larger than the elastic stresses and deformations produced by the same force applied statically.

Shock problems can be reduced to problems of stress by introducing the dynamic or static coefficient of impact between the dynamic stress and static stress forces.

So if the body weight is applied by dropping from a height h G, may be considered by hitting the body will be claimed by a force Fd> G[3].

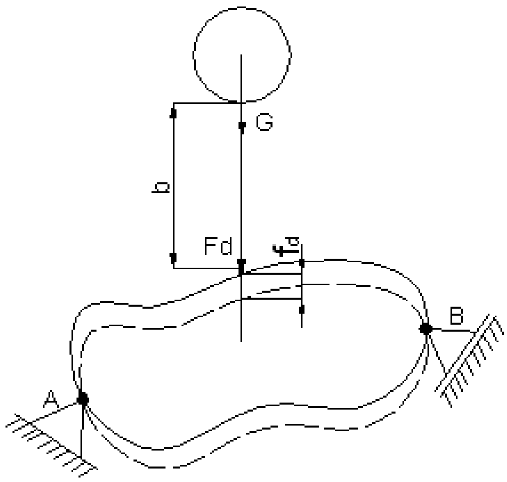

Fig. 1: *Fall of a load on a beam*

The ratio of $\frac{F_d}{G} = \psi > 1$ being the impact coefficient.

Positive number ψ, which is always greater than one (usually much greater than unity) is called coefficient of impact and the number of times are larger effects (stress and strain) produced by the dynamic loads, compared to the same charge applied without shock and called static load equivalent dynamic load studied.

Tensions and travel products applied statically G force will note σ_{st}, and the corresponding impact σ_d and f_d, considering elastic behavior of the material, so tensions and displacements are proportional to the forces which allows to write:

$$\frac{\sigma_d}{\sigma_{st}} = \frac{kF_d}{kG} = \psi \quad ; \quad \frac{f_d}{f_{st}} = \frac{k_1 F_d}{k_1 G} = \psi$$

In this way dynamic coefficient expresses an equal ratio among all sizes of the static and dynamic application

$$\psi = \frac{F_d}{G} = \frac{\sigma_d}{\sigma_{st}} = \frac{f_d}{f_{st}} \quad (6)$$

Sizes can be calculated so dynamic application of the static application of the dynamic amplification coefficient ψ:

$$F_d = \psi G; \quad \sigma_d = \psi \sigma_{st} \; ; \quad f_d = \psi f_{st} \qquad (7)$$

The expression of dynamic multiplier ψ is obtained from energy conservation law applied to shock:

E_c= W (8)

Where:

$$E_c = G(h + fd); \quad W = \frac{F_d f_d}{2} \qquad (9)$$

Taking into account the relations (7) by replacing in (8) is obtained:

$$G\left(h + \psi f_{st}\right) = \frac{1}{2}\psi^2 G f_{st} \quad (10)$$

Note

$$\frac{G f_{st}}{2} = W_{st} \quad ; \quad Gh = E_c \quad (11)$$

Is obtained the equation:

$$\psi^2 - 2\psi - \frac{E_c}{W_{st}} = 0 \quad (12)$$

With possible solution:

$$\psi = 1 + \sqrt{1 + \frac{2h}{W_{st}}} \qquad (13)$$

Or by replacing the energy

$$\psi = 1 + \sqrt{1 + \frac{2h}{f_{st}}} \quad (14)$$

According to the relation from above, the coefficient of static impact depends on the displacement f_{st}, meaning the body deformability subjected to shock. If static displacement is small (property they have fragile materials or brittle) shock is strong giving very big claims [3]. This explains the weak resistance to shock of glassware, ceramics etc. If deformable bodies, $f = 0$ and hence $\psi = \infty$.
High strength steels are deformed less than those of low resistance and therefore are not preferred for the manufacture of parts that must withstand the shock.
The minimum value is obtained for the impact coefficient $\Psi = 2$.
Impact coefficient can take values within $2 < \Psi < \infty$.
In most cases, the radical fraction under ψ coefficient is much greater than unity so that we can write,

$$\psi = \sqrt{\frac{E_c}{W_{st}}} = \sqrt{\frac{2h}{f_{st}}} \qquad (15)$$

Impact coefficient method is broad generality can be used in any application (simple or compound); in each case determining the correct arrow static typing it into his relationship ψ.Analyzing the impact factor important conclusion emerges that the parts that are designed to withstand the shocks must be as flexible, that provide large elastic deformations in static loading conditions are met.Thus springs of all kinds often used to mitigate shocks.

3.CONCLUSIONS

Impact coefficient method can be used in any application (simple or compound); in each case determining the static arrow correctly inserted into his relationship ψ. Shock required parts must be as flexible, that provide large elastic deformations in static loading conditions are met .Thus springs of all kinds often used for shock mitigation. For this method to be applied it is necessary deformations produced the hit in the shock body to be a linear-elastic, as in this case using elastic deformation potential energy accumulated in the body requested for shock.

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