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Health & Medicine

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Euler Buckling can be defined as the destruction of a thin vertical element which has come under compression, causing a sudden sideways deflection. Practically, Euler buckling is the sudden collapse of the structural member due to the exposure to high level of compressive stress. Euler buckling is normally described in terms of applied compression: one end of a beam is held fixed and the other end is moved towards the fixed end, eventually leading to buckled state. Metal building and steel framed structures are mostly affected by Euler buckling as they are erected structures. According to (Goraily, 2008, pg 1- 17)“ Euler buckling . Euler buckling is one of the most celebrated instabilities of classical elasticity “. Euler load is the largest practical load that can be applied to a bar.

As per (In, 2009, Pg. 477)“ Euler buckling is the classical example of the geometrical instability, where we consider the stability of a beam submitter to the compressive axial force P has been displaced by a perturbation with a small transverse displacement “. Under condition, where the resultant axial stress, due to the combined loading is compressive, the structure may fail by elastic instability. Failure can occur in a thin walled process column under an axial compressive load by buckling of the complete structure, as with a strut (Euler buckling) . Buckling instabilities affect structures which contain slender structural members or thin, shell like components.

The Euler buckling phenomena is elastic in nature. , At a sufficiently high load, structure collapse, by elastic buckling, plastic yielding or brittle crushing on the properties of material used in the structure. The elastic collapse is related to Euler buckling. Euler buckling is possibly the most widely encountered and studied buckling mode, both in theory and practice.

Here an example of Euler buckling in a grain storage facility is documented. The grain storage facility is 6-43-6” tall and was 20 years old. The buckling occurred due to strong wind and indentation was observed on the silo surface of grain storage facility. The wind was at the speed of 70 miles /hr and damage was caused to silo due to eccentric withdrawal as a result of imperfectly designed screw feeder.

High pressure from the wind caused distress at the base of the storage facility structure near the anchor belt area. Because the thickness of the plate is very thin, the walls of the silo tend to deflect. The wind force does not usually cause the buckling of the wall of silo. In the article (Sripadanna , 1993)mentions that " This case involves a group of 45-foot tall by 16-foot in diameter grain silos that developed localized buckling at approximately mid height. This type of phenomenon was wrongly attributed to wind loads from a storm event instead of the negative internal pressures exerted on the silo shells from unbalanced product removal”. Mainly Euler buckling occurs due to imperfection in the construction of the structure rather than external factors.

Figures showing the buckling in vertical grain silo

References

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