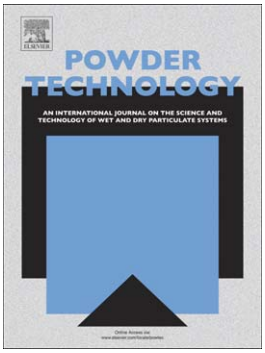

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Buckling design of large eccentrically filled steel silos

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Abstract

Large steel silos are typical kinds of thin-walled structure which are widely used for storing huge quantities of granular solids in industry and agriculture. In the present analyses, buckling design of circular steel silos subject to large eccentricity filling pressure are demonstrated in accordance with Eurocode: EN1990, 1991, 1993 [1-6]. The finite element model is established by using the commercial general purpose computer package ANSYS. Five types of buckling analyses are carried out for the geometrically perfect and imperfect models, with and without the consideration of the material plasticity, which are designated as LBA, GNA, GMNA, GNIA, and GMNIA in EN 1993 Part 1-6 [6].

Buckling behavior of five example steel silos with capacity of 40,000 to 60,000 m^3 is investigated whose slenderness ranges from 1.89 to 0.46, comprising intermediate slender and squat silos widely applicable in practical engineering. The results show that the buckling deformations are nonsymmetrical and the GMNIA analysis gives out the least buckling load factor for all example silos from all proposed buckling analysis types, and the load displacement curves are highly nonlinear and predict a distinct maximum load followed by a descending path, in which the maximum load is taken as the critical buckling point λ_{cr} for the equilibrium path.