

# **Stability analysis of single and bi-directionally, sinusoidally corrugated walls of steel sections**

Dissertation abstract

Single-directionally, sinusoidally corrugated in one direction sheets are used as the walls of I-beam steel sections. The necessity of making a curvy - welded joints between juncture of the web and flanges and the susceptibility to the accordion effect, limits the scope of their applicability in construction. Sinusoidal, bi-directional corrugated walls do not have the above disadvantages. However, their compression and shear stability analysis requires the use of a shell model. In case of dense corrugation, that model is described by differential equations with strongly oscillating coefficients. The use of such equations in the analysis of engineering issues is very troublesome, even when using finite element method. This work presents one of the averaging procedures leading to equations with constant coefficients, in which the corrugated plates are replaced by a certain equivalent continuous structure with mean stiffness modules that describe the properties of the actual plate.

The main aim of the study is to build a replacement model of the orthotropic plate, to demonstrate its applicability to the analysis of the stability of bi-directionally corrugated plates and to determine its area of applicability. Calibration is performed by using the proposed method of averaging to the plates corrugated sinusoidally, single-directionally and comparing it with known analytical solutions. After receiving the precise results, the stability of the bi-directionally corrugated plates has been described for which the averaging effective modules for the orthotropic model have been identified. The proposed model was validated by comparing the critical force values obtained from the orthotropic plate model and the FEM shell model. By automating the analysis process over 2000 specimens have been analyzed to achieve convergence of 95%.

In addition, in order to determine the future prospects of the study, an analysis of several more complex calculation models was performed by analyzing the beam girder with bi-directionally corrugated web for the accordion susceptibility, the impact of the web corrugation on the membership of the standard cross-section and its compression resistance in standard terms.

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