

Einladung zum Seminarvortrag im Aachener Mechanik & Statik Kolloquium

28. Februar 2017 | 14:00 Uhr

Institut für Allgemeine Mechanik | Templergraben 64 | 1. OG | Raum 112

RWTH AACHEN
UNIVERSITY

„ASYMPTOTIC METHODS IN THIN-WALLED STRUCTURE MECHANICS”

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Theory of shells contains various complicated and ill-posed multi-parametric problems. This is a natural field for application of asymptotic methods, because the researcher is able to discover a lot of small (large) parameters for further asymptotic procedure. Let us list some parameters applied in theory of shells and plates:

h/R is the ratio of shell thickness to its main size, i.e. radius;

l/L is the ratio of a period of non-homogeneity (l) to a characteristic size of considered structure (L) in the case of periodically non-homogeneous plates and shells;

a/b is the ratio of characteristic sizes (plate length to its width);

H/R is the ratio of shallow shell rise H to curvature radius R ;

w/h , where w is the normal displacement and h is the plate thickness;

B_1/B_2 ratio of bending stiffness of orthotropic shell.;

ω^{-1} , where ω is the dimensionless frequency of vibrations.

Presence of small parameters gives the possibility to use various asymptotic approaches: regular and singular perturbation; homogenization; homotopy perturbation, etc.

In my talk I'll discuss problems of asymptotic simplification of isotropic shell boundary value problems and homogenization of periodically non-homogeneous plates and shells. The homogenization method allows not only to obtain effective characteristics but also to investigate non-homogeneous distribution of mechanical stresses in different materials and structures what is of great significance for evaluating their strength.

The proposed methods yield simple and clear design formulae, useful for practical analyses in different engineering areas. Successful examples will be demonstrated. In particular corrugated and perforated plates and shallow shells will be analysed in details.

The proposed approaches can be used for improving of existing commercial codes. Even though some numerical approach is used, the structural analyst should remember, that "Design of computational or experimental schemes without the guidance of asymptotic information is wasteful at best, dangerous at worst, because of possible failure to identify crucial features of the process and their localization in coordinate and parameter space. Moreover, all experience suggests that asymptotic solutions are useful numerically far beyond their nominal range of validity, and can often be used directly, at least at a preliminary product design stage". (D.G.Crighton).

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