Shakedown of elastic plastic structures pdf

Von der Fakultät für Maschinenwesen. A bounded linearly kinematic hardening structure is subjected to a cyclic load, three distinctive situations may occur:

1. The structure behaves elastically and does not exhibit plastic deformation.
2. The structure undergoes plastic deformation that stabilizes after a finite number of cycles.
3. The structure fails plastically in addition to the plastic collapse at the limit load.

Plastic deformation either stabilizes after a finite number of cycles or results in failure. In continuum mechanics, elastic shakedown behavior is one in which the material returns to its initial stress state after a finite number of cycles.

For perfectly plastic structures, the upper bound algorithm has been established to determine the shakedown limit. Shakedown analysis for hardening structures has been investigated as well. In the first case, elastic shakedown is considered, while in the second, plastic shakedown is studied.

Elastic-plastic structures are used in the work for creating the structures volume. Elastic-plastic deformations are optimized by considering the elastoplastic range, which is possible thanks to the shakedown theory. Hybrid cross-sections taking into account the plastic reserve of the material are studied. The plastic reserve of the material is considered constant in time, which secures the elastic work of the structure. Shakedown load factors are evaluated for elastic perfectly plastic structures under cyclic loading.

In general, the methods of determining the safety of structures, based on the theory of shakedown, are applied. A kinematical approach, started from the structure of the loading domain, is developed for shakedown analysis of elastic-perfectly plastic bodies. Reduced-order models are used to analyze the behavior of these structures under cyclic loading. Optimal shakedown design of elastic-plastic structures is considered when optimizing structures with elasto-plastic deformations.

Elastic shakedown or simply shakedown of a system is regarded as a safe state. Here, the focus is on determining the elastic shakedown limit, below which failure is prevented. The theory of shakedown is applied to structures subjected to cyclic loading, enabling the shakedown limit of a general elastic-plastic structure to be determined.