

The Redundancy Matrix as an Alternative Measure for the Assessment of Structures

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Abstract

For the design of load-bearing structures redundancy and thus the degree of static indeterminacy plays an important role. According to Linkwitz and Ströbel [1], the distribution of static indeterminacy in the system can be described by the redundancy matrix containing the redundancy contributions of all elements. The redundancy contribution of one element quantifies the internal constraint of the surrounding structure on this element. The sum of the redundancy contributions of all elements is equal to the degree of static indeterminacy of the entire structure.

The extension of this notion presented by Ströbel for discrete truss systems to frames and continua can yield valuable insight into the load-bearing properties of a structure and has the potential to become an exciting new branch of the classical field of structural analysis.

Of course, the statical indeterminacy and its distribution in a structure have a decisive influence on the load-bearing behavior. Therefore, the redundancy matrix can be a good measure to understand and assess the load-bearing behavior of structures. Furthermore, it can be used for robust design optimization and the assessment of imperfection sensitivity during the assembling process.

The redundancy calculation for truss and frame structures will be explained and mathematical and mechanical properties of the redundancy matrix will be discussed.

References

- [1] D. Ströbel, *Die Anwendung der Ausgleichsrechnung auf elastomechanische Systeme.*, Ph.D. thesis, University of Stuttgart, 1995.