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Redundancy Distribution and Adaptive Structures

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Already for the design of a passive load bearing system redundancy and thus the degree of static indeterminacy plays an important role. According to Ströbel [1] the distribution of the static indeterminacy in the system can be described by the redundancy contribution of each element of a truss. The sum of the redundancy contributions of all elements is equal to the degree of indeterminacy of the entire structure.

The extension of this notion presented for truss systems by Strbel to frames and continua or thin-walled structures yields valuable insight into the load bearing of a structure but at the same time it poses some scientific challenges.

Also for the integrative design of efficient adaptive structures in civil engineering the redundancy distribution can be applied. The redundancy matrix, containing the redundancy contributions of all elements, is directly related to the space of adaptability. During the design process the eigen vectors of this space can be used to evaluated how good the stress distribution of a system can be adapted without specifying the number or positions of the actuators. The space of adaptability can also be used to find favourable positions for the actuators taking into account the controllability without application of complex and time consuming optimization algorithms.

The aim of this work is to get a better insight into the load bearing behaviour of adaptive systems and characterize them. Thereby an integrative design of optimal adaptive structures based on insights to the load bearing behaviour and not on complex optimization algorithms should be enabled.

REFERENCES

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