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# Actuation concepts for structural concrete elements under bending stresses

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The population growth is a big challenge for the construction sector. Because of the limitation of resources, new radical approaches must be investigated. Werner Sobek states that only new methods of construction can overcome this challenge [1]. Especially concrete constructions need to be reconsidered because concrete is the most common construction material. In some regions of the world there is already a scarcity of sand, the main aggregate of concrete.

The Collaborative Research Centre "Adaptive Skins and Structures for the Built Environment of Tomorrow" at the University of Stuttgart deals with this challenge by applying the concept of adaptivity to building structures and envelopes. It describes the ability to react to external loads by implementing sensors, actuators and control units into the structure. This method was first described in 2000 by Werner Sobek [2]. In this context the project "Integrated fluidic actuators" investigates the resource saving potential of the adaptivity of beams and slabs. The necessity of this research field becomes obvious with a closer look at the built environment. It shows that in nearly every residential and office building beams and slabs are used and the slabs account for nearly 50 % of the whole structure's weight [3]. Here it is remarkable that the design load nearly never occurs during the lifetime of the construction, which leaves a high amount of material unused for most of the time. Therefore, sensors identify if the design load takes effect and a control unit causes a reaction by activating actuators simultaneously. In addition to previous studies, linear actuators are integrated into the load-bearing section of the structural element, so that stress fields are manipulated in a more direct and effective way. Exerting forces onto beams and slabs induce stresses in a way that non-constant bending stresses become almost neutralized. The integrated actuator is designed to influence not only static but also dynamic load scenarios. Therefore, the actuator needs to induce large forces into the surrounding structure within a short period of time. This paper will depict different actuation concepts to minimize the deflection of beams and slabs in order to significantly decrease the used construction material.

## REFERENCES

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