Discrete Particle Model for Fastening Applications

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ABSTRACT

The efficient and permanently safe design of fastening systems requires a thorough understanding of all involved load carrying mechanisms and their potential change in course of time due to deterioration and material ageing. The latter are determined by the involved materials - concrete, steel, and, depending on the system, the mortars. In this contribution we focus on concrete cone failure, the dominant failure mechanism for bonded as well as mechanical anchors under predominant tension loading.

Current design codes are based on concrete compressive strength as material parameter characterizing the ultimate capacity. This practice may be desirable from a practical point of view, however fails to capture many significant influence factors arising from the concrete composition and e.g. the used coarse aggregate.

Utilizing a well-established discrete particle model we present the calibration and validation of pull-out tests performed in normal strength concretes. The validated models afterwards serve for an in-depth analysis of the fracture process and a sensitivity study linking the meso-scale material parameters to macro-scale parameters and characteristics of the investigated fastening system. In particular the crack localization, cone development and the stress evolution in the developing crack will be linked to the regimes of the macroscopic response.