

Dissertation Release

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Simulation of quasi-brittle fracture in civil engineering structures: a numerical model and its applications

Title of the dissertation	Nonlocal continuum damage models for quasi-brittle fracture: algorithms and applications.
Contents of the dissertation	<p>Quasi-brittle fracture, which is the main type of failure in mineral-based materials such as rock, limestone, and concrete, causes significant damage to infrastructure systems and great loss of lives. Hence, the estimation or design of the ultimate capacity of load-bearing members within this class of materials has captivated researcher's attention in the recent years and has been a major branch of computational mechanics, besides theoretical and experimental approaches.</p> <p>To address the problem, this thesis focuses on the further development of a nonlocal continuum damage model to accurately predict the initiation and evolution of damage and the progressive failure in structural materials. Several applications of the damage model have been presented, including the study of specimens with stochastic variations of the material parameters to discover the consequences on the behaviour and failure of the variability of each investigated material parameter. To study the size dependent responses of microarchitectural materials, the damage model is extended in light of Mindlin's strain gradient elasticity theory by enriching the first and second gradients of strain in the free energy functional. Lastly, the proposed nonlocal damage model is combined with a dimensionally reduced model of functionally graded plates using a third-order shear deformation theory, where the field variables are computed on the neutral surface of the plate. Unlike the conventional three-dimensional solid models, integration over the plate thickness is not required, which noticeably reduces the computational effort.</p>
Field of the dissertation	Civil engineering – Computational structural mechanics
Doctoral candidate	Hoang-Anh-Tuan Nguyen, M.Eng, born in 1989 in Saigon (Vietnam)
Time of the defence	14 October 2021 at 12:00 hours
Place of the defence	Remotely via Zoom: https://aalto.zoom.us/j/7799660770 (Aalto University School of Engineering, Department of Civil Engineering, Otakaari 1, 02150 Espoo, Finland, Auditorium M1)
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