Research of cfrp strengthened flexural reinforced concrete beams

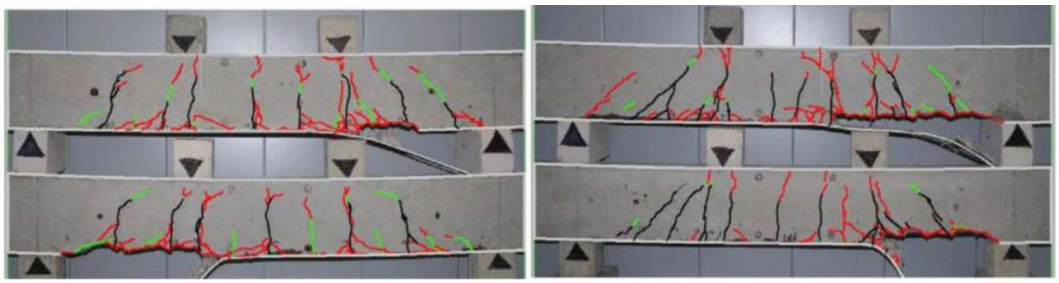
Summary

Strengthening of reinforced concrete structures is highly relevant since the moment of the emergence of reinforced concrete. The reasons for strengthening can be various, but the main ones are the insufficient strength and/or stiffness. It is especially relevant when there is necessity to increase the load-bearing capacity due to additional loads. Due to its properties, carbon fibre (CFRP) is a suitable material for increasing the load-bearing capacity of reinforced concrete structures. The tensile strength of carbon fibre can be greater than 2000 MPa. What is more, using this kind of a thin material for strengthening does not increase the cross-section of the structure. Furthermore, the preparation for strengthening is relatively easy, and this kind of strengthening increases corrosion resistance. Despite the relatively high cost, carbon fibre is used to strengthen beams, columns, slabs, and bridge structures. It is common that, in most cases, already existing structures are cracked. Thus, it is difficult to evaluate whether the strengthened structure would withstand the design loads. Therefore, analysis of flexural cracked and carbon fibre strengthened reinforced concrete beams has been carried out in this dissertation. An analytical method evaluating the bond (shear) force of the cracked (with low cracking intensity) element and tangential (shear) stress between the carbon fibre and the concrete over the length of the element has been proposed.

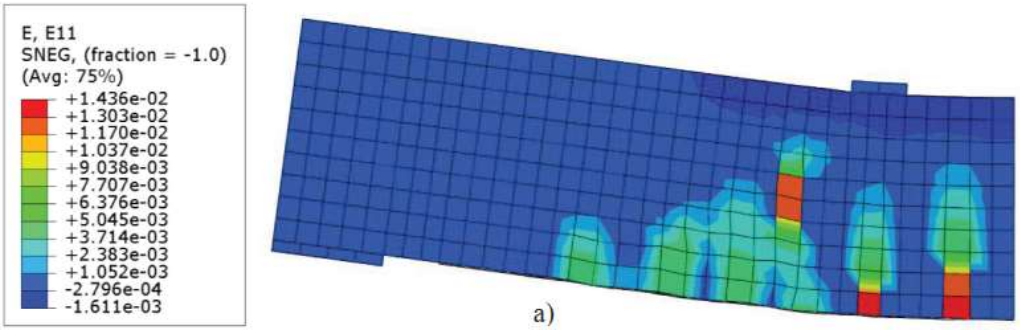
The aim of this dissertation is to propose an alternative analytical methodology that would allow to calculate the bond (shear) force and tangential (shear) stress between the carbon fibre and the concrete of the uncracked and cracked (with low cracking intensity) flexural element while estimating the slip of the layers over the length of the element.

Keywords

CFRP, pre-cracks, ABAQUS, strengthening.



Pre-Crack beam strengthed with CFRP.



ABAQUS simulation with Pre-Crack and later strengthed with CFRP.

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