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Numerical study on bonding strength of ribbed reinforcing bars in UHPC with material ductility

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1 Abstract

This paper mainly studies the bonding mechanism of ribbed steel reinforcing bars in ultra-high performance concrete (UHPC) considering the influence of material ductility. In recent years, the bond slip behavior of reinforcing bars in UHPC has received extensive attention. In the previous pull-out tests, it was found that the classical splitting theory still plays role in bond failure modes. In this paper, the pull-out test is simulated by finite element analysis, and it is found that unlike ordinary concrete, UHPC can still hold the load for a period of time after the tensile stress on splitting surfaces reaches the critical value, due to the ductility of the material. It is found from the numerical results that the bonding stresses are not evenly distributed along the steel bar when the pull-out failure occurred. Through theoretical analysis and experimental verification, the maximum bonding force of ribbed reinforcing bars in UHPC is closely related to the material ductility. Based on this, a new theoretical model for calculating the bonding strength of ribbed steel reinforcing bars in UHPC is proposed, and can be used for the design method of urban bridge built with UHPC.

Keywords: bonding strength; UHPC; ductility; numerical study; model test.

2 Introduction

In order to obtain the bonding strength of ribbed reinforcing bars in UHPC, much research was conducted on the failure mode of reinforcement bonding in UHPC. Alexander B. Sturm [1] summarized the pull-out failure modes of two types of reinforcing bars in UHPC from the bond-slip curves of bars under different parameter tests.

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