|  |  |
| --- | --- |
|  | xh1 |
|  |



继续教育学院

成人高等教育本科毕业设计（论文）

**混凝土梁桥粘贴FRP加固后裂缝宽度计算方法（论文题目）**

|  |  |  |  |
| --- | --- | --- | --- |
| 院 系 | 继续教育学院 | | |
| 专 业 |  | | |
| 教 学 点 |  | | |
| 班 级 |  | | |
| 姓 名 |  | 指 导 教 师 |  |
|  | 年 月 日 | | |

# 

**Calculation Method for Reinforced Concrete Beams Strengthened with Externally Bonded FRP（题目英文）**

使用英文字体：Times New Roma （小二）

**Candidate：Li Bai（自己名字拼音）**

使用英文字体：Times New Roma（小三）

**Supervisor：Meng Haoran（老师名字拼音）**

使用英文字体：Times New Roma（小三）

School of Continuing Education of Chang’an University

使用英文字体：Times New Roma（小三）

# 摘要

通过在受拉区粘贴纤维复合材料（FRP）来改善混凝土结构的受力性能是一种新型旧桥加固方法，在世界范围内得到了越来越广泛的应用。纤维复合材料因其强度大、自重小、维护费用低等众多优点，在桥梁加固领域展现出很大的应用潜力。为了评价构件在加固后的正常使用性能，需要对构件的裂缝宽度与挠度进行验算。

本文主要研究了FRP加固混凝土梁的裂缝宽度计算方法。首先通过搜集国内外大量关于FRP加固混凝土受弯构件的模型试验资料，归纳总结国内外各规范关于混凝土受弯构件与FRP加固混凝土受弯构件的的裂缝宽度计算方法，分析了影响FRP加固混凝土结构裂缝宽度的因素以及裂缝宽度计算模式。结果表明影响混凝土结构裂缝宽度的因素有钢筋应力、FRP应力、钢筋表面形状、配筋率（等效配筋率）、混凝土保护层厚度、中性轴距钢筋形心的距离等。各规范裂缝宽度的计算依据有统计方法、粘结滑移理论，无滑移理论和综合理论。（摘要例）

关键词: 纤维复合材料; 钢筋混凝土梁; 抗弯加固; 裂缝宽度; 计算方法（关键词例，注意用分号隔开）

**Abstract** 使用英文字体：Times New Roma（小四）

Bonding fiber reinforced polymers (FRP) on the tensile zone to strengthen concrete structures is a new method to strengthen old bridges, which is more and more commonly used worldwide. Because of high strength, low self weight and low maintenance cost, FRP presents big utilization potentiality in the bridge strengthening field. In order to evaluate the structural performance in serviceability state after strengthening, the calculation of crack width and deflection of the strengthened structures is in need.

This paper mainly focused on the calculation method for crack width of FRP-strengthened reinforced concrete structures. First, by collecting the model test data and exploring the calculation method of different design codes, the main reasons resulted in the crack width were summarized and the calculation modes were concluded. The stress of steel bars and FRP, surface shape of steel bars, reinforcement ratio, thickness of concrete cover and the distance between neural axis and steel centroid are the key influencing factors of crack width. And the calculating modes nowadays are slip theory, slip-nonslip synthetic theory and mathematical statistics method.

And then, this paper proposed three calculating methods to calculate the crack width of FRP-strengthened concrete structures, some formula among which based on FRP slip theory proposed by this paper. There methods, respectively, are statistical method, semi experimental and semi theoretical method with statistical spacing and semi experimental and semi theoretical method with statistical bonding stress. The first method is purely statistical method; The second method obtained the crack spacing by statistics, mean stress of steel bar and FRP by nonuniformity coefficient, and crack width expression by synthetic theory and FRP slip theory respectively; And the third method obtained the crack spacing by equilibrium, the mean stress of steel and FRP by tension stiffening coefficient, and crack width expression by synthetic theory and FRP slip theory respectively.

The data collected in this paper showed that these methods possess certain precision, thus having reference value for engineering practice. Furthermore, this research would make contribution to the further study of FRP-strengthened structures under serviceability limit state.

**Key words**: FRP; reinforced concrete beam; flexural strengthening; crack width; calculation method（英文摘要与英文关键词）

使用英文字体：Times New Roma（小四）