

Parametric study of the simplified methodology for the design of structures in reinforced concrete according to the new version of NBR6118-2014.

João Victor Burlamaqui Coelho (IC), Luiz C. de Almeida (PQ), Gustavo H. Siqueira (PQ).

Abstract

The incessant search for better technologies and working methods in the field of construction is closely linked and has as main effect the appearance of concrete (most used material for building in the world) with increasingly optimized features and better performance. Following this trend, the new Brazilian standard for reinforced concrete - NBR6118-2014 - allowed, among other descriptions and processes, the adoption of a simplified model of design of such elements, known as rectangular model stresses. The aim of this study is to compare the simplified method to the process of direct integration of material behavior curve.

Key words: reinforced concrete, rectangular model of tensions, parametric study.

Introduction

Interest in the concrete as a building material comes from ancient Egyptian and Greco-Romans, who used cement pastes and mortars for cementing their buildings, many of which are still standing. Over the years, technologies have been modified, only being incorporated in the concrete. The most revolutionary, however, was the addition of steel for the formation of reinforced concrete. There is no single way to arm the concrete, because the material has as main feature and that also allows one of its ratings, resistance to compressive stresses. Thus, we can establish four main areas of deformation, based on the stress and strain they are subjected to the concrete and steel with the help of the neutral line concept of the cross section. This work aimed to analyze some of the key sections used in structures according to domains and described two types of concrete, provided in standard between 20 and 50 MPa and between 50 and 90 MPa compressive strength. The study focuses on the comparison between the commonly used rectangular model of tensions (simplified) and parametric analysis of stress/strain curve, by means of numerical integration, seeking to establish boundaries for the simplification.

Results and Discussion

Initially took up the rectangular section in the domain 2 (since 1 is merely theoretical) because the variable β is constant at the boundary with the domain 3, equal to 0.259, and compressive strengths up to 50 MPa. With the help of computational tool PTC MathCAD Prime 3.0, it was possible to perform various simulations with values similar to the real. We established values to the neutral line (X), setting the variable (y) equal

to the height of the rectangle and the width of the modifying part (bw), obtaining thus the resulting compression (Rc). For this condition, it was found that both results are identical or differ at most by 0.05% due to the specificity of the studied area and shape of the section. Leaving for the subsequent step, in order to extend the process and perform a changing variable of integration (in order to work with the known dimensionless coefficient β rather than the specific strain), it was found that the end of the quadratic parabola and early rectangle does not coincide necessarily with 0.2% fiber deformation.

Conclusions

The results demonstrate the difficulty of adopting a model closer to reality to generalize the analysis of the behavior of reinforced concrete to axial compression. Although it has not gone ahead with other sections and domains due to the inability found in doing the variable of integration follow the characteristic curve throughout the entire cross-section, the rectangle one studied with the simplified model is correct for all cases.

Acknowledgement

This work was supported by the Brazilian agency CNPq.

¹ Fernandes, G. B. Notas de aula, FEC-Unicamp, Campinas, 1980.

² Pinheiro, L. M. Estruturas de Concreto, Capítulos 1 e 2, EESC-USP, São Carlos, 2004.

³ Associação Brasileira de Normas Técnicas. NBR – 6118: Projeto de Estruturas de Concreto, Rio de Janeiro, 2007.

⁴ Associação Brasileira de Normas Técnicas. NBR – 6118, 2014.