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Nonlinear models for design of circular RC columns under ultimate and service states

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Abstract

The present paper is dedicated to the ultimate and to the service design of circular reinforced concrete sections under axial load and bending moment, according to Eurocode 2 [1].

The objective of the present work is to develop design equations for circular reinforced concrete sections, solving the equilibrium equations by mathematic symbolic software. The concrete only supports compressive stresses and the steel can hold both tension and compression. The nonlinear equation of EC2 [1] is used for compressed concrete in the ultimate design. The steel is considered to have a linear elastic constitutive law up to the yield stress, followed by a plastic behaviour. The ultimate design condition is posed in terms of maximum strains for the most compressed concrete fibre or for the tensioned steel bar, permitting the definition of interaction abacuses, shown in the present paper.

Keywords: Reinforced concrete; circular section; circular columns; bending moment; axial load; limit ultimate design; limit service design; Eurocode 2.

1 Introduction

The analysis of reinforced concrete columns under axial load and bending moment is an important issue for structural concrete design either in academic or in engineering practice. To satisfy this objective, the work by Barros et al [2] uses a mathematical manipulation software to implement the models for ultimate and service limit state. This software delivers results in terms of abacuses and tables, useful in practical design, considering variable steel strength and reinforcement layouts and different concrete classes.

The design abacuses take the form of interaction bending moment and axial load for fixed values of the maximum stress in compressed concrete equal to $0.45f_{ck}$ and $0.60f_{ck}$, for the service limit state, where f_{ck} is the characteristic compressive concrete strength. These abacuses are described in Barros et al [2].

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