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Gintaris Kaklauskas

Vilnius Gediminas Technical University, Lithuania

A new concept of crack analysis of reinforced concrete members

The current study proposes a new concept of crack analysis of reinforced concrete (RC) members. The novel philosophy behind the proposed concept is to establish the mean crack spacing and width through the compatibility of the stress-transfer and mean deformation approaches by equating the mean strains of the tensile reinforcement defined analytical techniques. The concept considers primary cracks at the stage of stabilised cracking assuming that a single RC block of a length of the mean crack spacing represents the averaged deformation behaviour of the cracked member. Based on the experimental evidence, reinforcement strain within the block is characterized by a strain profile consisting of straight lines. The latter represent three different zones that are described by different bond characteristics. Crack spacing is defined as the sum of lengths of these zones within the length of the block. The proposed model involves the least amount of empiricism and is devoid of empirically established effective area of concrete. A preliminary statistical analysis of mean crack spacing using limited test data has demonstrated good predictive capabilities of the model resulting in 15% of the coefficient of variation. The proposed approach allows a critical assessment of the classical bond theory in regard to its fundamental statement relating crack spacing to Ø/pef ratio. A preliminary study has shown that the larger are the member's section depth and the reinforcement ratio, the more the classical approach deviates from reality. It can be deduced that crack spacing is mostly governed by four geometrical parameters given in the order of importance: section height, reinforcement ratio, bar diameter and cover.

Biography

Gintaris Kaklauskas is a Professor of Department of Reinforced Concrete Structures and Geotechnical Engineering and Director of Research Institute of Building Structures at Vilnius Gediminas Technical University (VGTU). He received his PhD and DrSc (Habilitation doctor) degrees from VGTU. He is Member of Lithuanian Academy of Science and recipient of ASCE best paper Moisseiff Award 2013, Lithuanian Science Prize 2013 and Marie Curie (Senior Research category) grant. He is Visiting Professor (under Fulbright fellowship) at University of Illinois, Urbana-Champaign. His research interests include service ability analysis and constitutive modeling of concrete structures.

gintaris.kaklauskas@vgtu.lt

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