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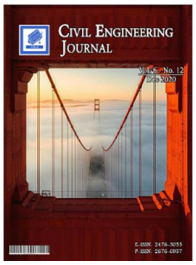

New Approach for Simulating Reinforced Concrete Walls in Quasi-static Loading

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Abstract

The main objective of this article is to apply a simplified model to simulate the overall behavior of a reinforced concrete wall without the need to explicitly represent the reinforcing bars in the model nor the progressive degradations of the concrete in tension. The model takes into account the fictitious laws of the material, in order to estimate the capacity of the studied model and its performance to simulate the complex behavior of concrete. The law of the fictitious behavior of reinforced concrete tie rods is based on the shape of the adhesion curve between steel and concrete. Relationships covering the cracking stage up to the elastic limit of steel are proposed according to the properties of concrete and steel materials, the percentage of steel. An analytical computational model is then implemented in the Matlab programming language. Necessary transformations for the integration of the law of fictitious average behavior of steel in the Abaqus software were carried out thus making it possible to make a considerable advance from the point of view of validation of the developed law. The general formulation of the tension law applies to sections where the reinforcements are distributed so that the resistance of the entire section is mobilized. Hence the need to introduce an effective area around the rebars for the application of the fictitious tension law to reinforced concrete walls. Numerical simulations have been validated using an example of reinforced concrete wall subjected to a quasi-static loading. Load-displacement responses are compared and the numerical results approaches well the experimental one. By using the law of the fictitious diagram of the concrete and by defining the effective tensile zone of the wall, the model makes it possible to save a considerable time of calculation compared to a traditional calculation in EF on Abaqus.

Keywords: Reinforced Concrete; Fictitious Law of the Tie; Steel-concrete Adhesion; Effective Area of the Tie.

1. Introduction

It is well known that the tensile strength of concrete is generally neglected when it comes to dimensioning and stress checks. However, it is important to consider the contribution of concrete in tension for a better prediction of the behavior of reinforced concrete structures. The problem of the contribution of tensioned concrete between cracks and steel / concrete adhesion has been widely studied in the literature in the context of reinforced concrete tie rods leading to the formulation of different laws for the fictitious average behavior of steel. However, a certain number of parameters influencing the fictitious average behavior of steel remains to be studied and so far we do not see the transfer of this type of law to the scale of the structure under various loading conditions (other than traction).

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