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Computational Aided Approach for Strut and Tie Model for Non-Flexural Elements

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Abstract : The challenge of the research is to provide engineering with a robust, semi-automatic method for calculating optimal reinforcement for massive structural elements. In the absence of such a digital post-processing tool, design office engineers make intensive use of plate modelling, for which automatic post-processing is available. Plate models in massive areas, on the other hand, produce conservative results. In addition, the theoretical foundations of automatic post-processing tools for reinforcement are those of reinforced concrete beam sections. As long as there is no suitable alternative for automatic post-processing of plates, optimal modelling and a significant improvement of the constructability of massive areas cannot be expected. A method called strut-and-tie is commonly used in civil engineering, but the result itself remains very subjective to the calculation engineer. The tool developed will facilitate the work of supporting the engineers in their choice of structure. The method implemented consists of defining a ground-structure built on the basis of the main constraints resulting from an elastic analysis of the structure and then to start an optimization of this structure according to the fully stressed design method. The first results allow to obtain a coherent return in the first network of connecting struts and ties, compared to the cases encountered in the literature. The evolution of the tool will then make it possible to adapt the obtained latticework in relation to the cracking states resulting from the loads applied during the life of the structure, cyclic or dynamic loads. In addition, with the constructability constraint, a final result of reinforcement with an orthogonal arrangement with a regulated spacing will be implemented in the tool.

Keywords : strut and tie, optimization, reinforcement, massive structure
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