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TOPOLOGY OPTIMIZATION OF REINFORCED CONCRETE STRUCTURE USING TRUSS-LIKE MATERIAL MODEL

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Abstract: Topology optimization of steel and concrete composite based on truss-like material model is presented. The initial design domain is filled with steel and concrete continuously. Structure is analyzed by finite element method. The densities and the orientation of steel at nodes are taken as design variables. The densities of steel are adjusted according to stress ratio method of fully-stressed criterion; the orientation of steel are aligned along maximum principal stress directions. The continuous material distribution field in every element is formed by the interpolation of the material at the nodes belonging the element. Optimizing distributed field of steel, the volume of steel material is minimized under stress constraint. The truss-like continuum constituted with steel and concrete composite is optimized. Several numerical results indicate the numerical instability. More details of manufacture and construction can be presented based on the truss-like material model. The position and orientations of reinforcement of concrete are suggested by the optimization result. Hence, the truss-like material model of steel and concrete is efficient to establish the distribution of steel material in concrete.