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Biogeography Based CO2 and Cost Optimization of RC Cantilever Retaining Walls

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Abstract : In this study, the development of minimizing the cost and the CO2 emission of the RC retaining wall design has been performed by Biogeography Based Optimization (BBO) algorithm. This has been achieved by developing computer programs utilizing BBO algorithm which minimize the cost and the CO2 emission of the RC retaining walls. Objective functions of the optimization problem are defined as the minimized cost, the CO2 emission and weighted aggregate of the cost and the CO2 functions of the RC retaining walls. In the formulation of the optimum design problem, the height and thickness of the stem, the length of the toe projection, the thickness of the stem at base level, the length and thickness of the base, the depth and thickness of the key, the distance from the toe to the key, the number and diameter of the reinforcement bars are treated as design variables. In the formulation of the optimization problem, flexural and shear strength constraints and minimum/maximum limitations for the reinforcement bar areas are derived from American Concrete Institute (ACI 318-14) design code. Moreover, the development length conditions for suitable detailing of reinforcement are treated as a constraint. The obtained optimum designs must satisfy the factor of safety for failure modes (overturning, sliding and bearing), strength, serviceability and other required limitations to attain practically acceptable shapes. To demonstrate the efficiency and robustness of the presented BBO algorithm, the optimum design example for retaining walls is presented and the results are compared to the previously obtained results available in the literature.

Keywords : bio geography, meta-heuristic search, optimization, retaining wall
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