

A nonlinear quadrilateral thin flat layered shell element for the modeling of reinforced concrete wall structures

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In this article, a simple and accurate quadrilateral thin flat layered shell element formulation for the nonlinear analysis of reinforced concrete (RC) wall systems under static and cycling loads is presented. The 4 node shell element, with 6 degree of freedom (DOF) per node (3 displacements and 3 rotations) is created by superposing the quadrilateral layered membrane element with drilling degrees of freedom (12 DOF, 2 displacement and 1 rotation per node) developed by Rojas et al. (Eng Struct 124:521-538, 2016), and the Discrete Kirchhoff Quadrilateral Element (12 DOF, 1 displacement and 2 rotations) formulated by Batoz and Tahar (Int J Numer Methods Eng 18(11):1655-1677, 1982), to model the in-plane and the out of plane bending behavior of the shell element, respectively. In addition, to model the complex behavior and coupling of the axial, flexural and shear behavior, observed in complex RC wall structures, the transversal section of the shell element con