REINFORCED CONCRETE SHEAR WALL: STRUCTURAL ELEMENT - FINITE ELEMENT

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Key Words: *Structural Model, Statics, Dynamics, Reinforced Concrete Shear Wall.*

The contribution deals with simplification of structural models in civil engineering. The main goal is to improve the effectiveness of the static and dynamic analysis with sufficient accuracy. The paper focuses the reinforced concrete shear wall element application into the model of the structure.

Reinforced concrete shear walls are frequently used in civil engineering as structural elements resisting horizontal forces acting on the structure. The reinforced concrete is a composite consisting of concrete with nonlinear behavior from the beginning of the loading and steel reinforcement characterized by yielding point and mesh geometry. The stress-strain relation of reinforced shear walls during loading is not easy to describe theoretically due to complex destructive phenomena including concrete cracking, interaction effects between steel and concrete, steel yielding and concrete crushing in compression [3], [4], [5], [6]. Experimental testing shows the real shear behavior of the wall [1].
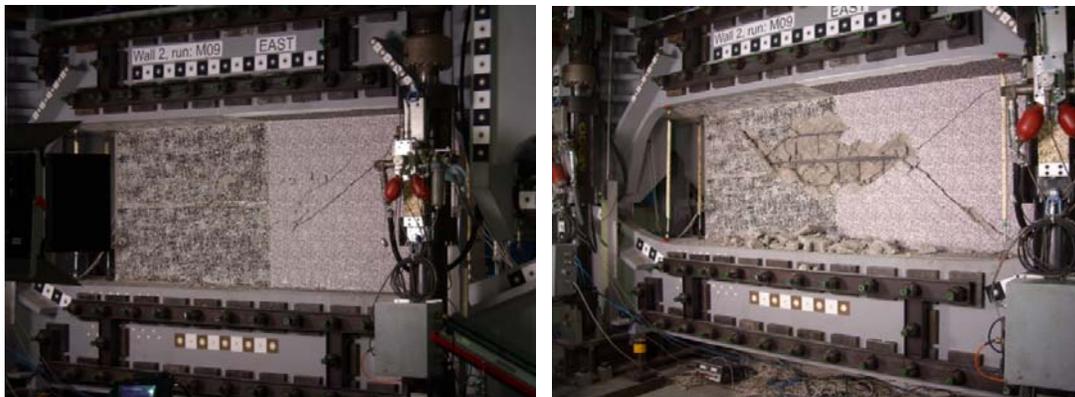

Fig.1, 2 The reinforced concrete shear wall testing at the ELSA laboratory (IRIS project)

The hysteresis obtained as the result of the testing is applied for derivation of the nonlinear spring element with single degree of freedom. The features of the derived element are specific for reinforced concrete: include the pinching effect, the concrete cracking, the stiffness degradation and yield effects. The element can be built in the arbitrary structural finite

element model [2], [7]. Application of the mentioned SDOF element instead of FE model of the whole wall decreases the system matrix size and improves the efficiency of the analysis.

The application of the derived element is suitable in nonlinear mechanics.

The advantage of the reinforced shear wall model with single degree of freedom is that the whole shear wall is represented by only one element and provides a global view on this structural part of the civil structure.
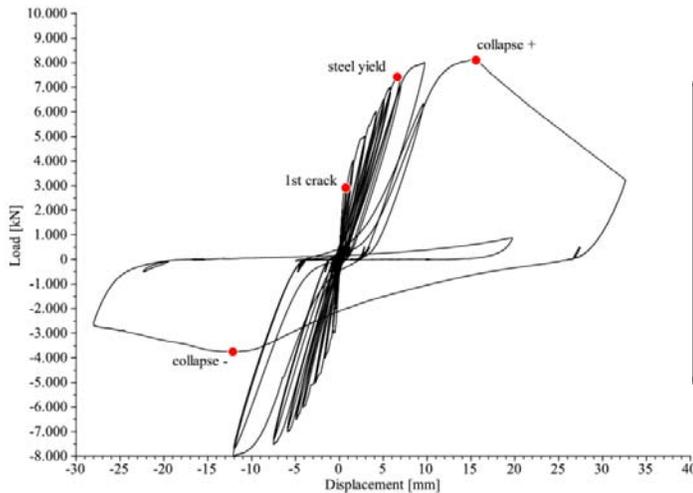

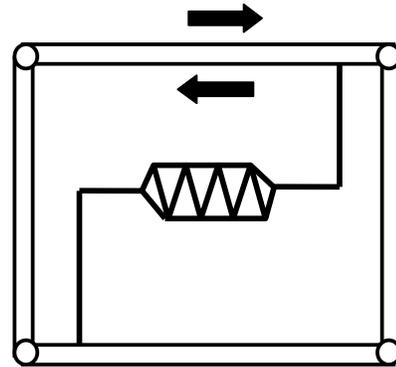Fig.3 The test hysteresis: horizontal load vs. horizontal displacement

Fig.4 Model of the shear wall: nonlinear element

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