COMSOL Multiphysics® Simulations of Cracking in Point Loaded Masonry with Randomly Distributed Material Properties

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Abstract

In buildings with masonry walls these walls support the concrete floors. To reduce buckling effects in the wall and to improve the floor wall interaction a centering strip is positioned between the wall and the floor. The width of this strip is smaller than the thickness of the wall and so the contact surface area is smaller than the full wall section. Consequently, the contact stresses are higher and less uniformly distributed than with full contact. The advantage, however, is that the floor can rotate more easily while the position of the reaction force remains more in the center of the wall.
This paper concentrates on the stress and crack development in the floor-wall area as found with COMSOL Multiphysics® simulations. The simulation results are compared with experimental findings. The main parameter was the position of the centering strip on the wall. In the performed non-linear simulations, the material properties like Young's modulus and tensile strength are varied over the volume of the specimen. The results of a number of simulations, for different strip-positions and each time with different randomly assigned material properties show the effects of varying material properties on stress distribution and cracking behavior in point loaded masonry.

Figures used in the abstract

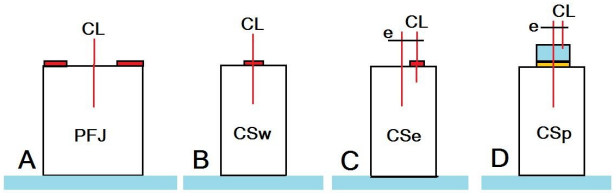

Figure 1: Load introduction principles. CL = centre line of loading

Figure 2: Split specimen with traces of centre strip after testing

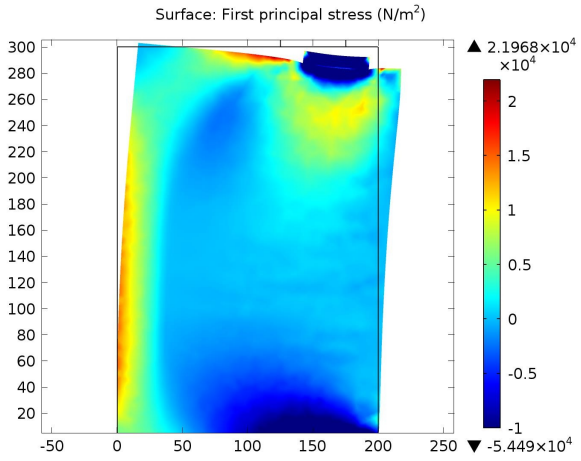

Figure 3: First principal stress distribution in eccentrically loaded specimen