Thermo-Hydro-Mechanical Model for Modelling of Plaster and Autoclaved Aerated Concrete Wall Interaction

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Abstract

One of the popular building material represents autoclaved aerated concrete (AAC) which becomes popular in last decades because of its good thermal insulation properties, adequate mechanical properties, low bulk density and last but not least reasonable price. Contrary to these advantages, the AAC also suffers by significant shrinkage induced by the changes of the water content which can lead to crack propagation in the AAC material and also in cast plasters.

In this paper, three types of equations are solved during nonlinear coupled transport problems. There are constitutive equations representing the material properties, transport equations such as Fick's law, Darcy's law or Fourier's law and continuity equations. In the Künzel model, two unknowns are introduced for each material point - relative humidity ϕ [-] and temperature T [K]. Additionally, it is supposed that the moisture trans- port mechanisms relevant to numerical analysis in the field of building physics are just water vapor diffusion and liquid transport [1].

The mechanical behaviour is described with the help of isotropic damage model involving evolution of shrinkage strains [2] with respect to change of volumetric moisture content. A special treatment is paid to the interface between plaster and the wall where special finite contact elements are used. The numerical model was used analysis of real structure and its parameters were obtained by laboratory tests.

References

1. H. M. Küunzel and K. Kiessl. Calculation of heat and moisture transfer in exposed building components. Int. J. Heat Mass Tran. 40, (1997), 159-167.
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