Multi-physical and multi-scale deterioration modelling of re-inforced concrete: modelling corrosion-induced concrete damage

In this paper, corrosion-induced damage is investigated by means of numerical simulations utilizing a coupled lattice and finite element method (FEM) modelling approach. While the reinforcement and corrosion product domain are discretized by the FEM, a lattice approach is used for the discretization of the concrete domain. To model the expansive nature of solid corrosion products, a thermal analogy is used. The modelling approach further accounts for the penetration of solid corrosion products into the available pore space of the surrounding cementitious materials and non-uniform distribution of corrosion products along the circumference of the reinforcement. Finally, results of numerical simulations in terms of corrosion-induced deformations and cracking are compared to experimental data obtained by digital image correlation and published in the literature.