Prediction of corrosion in reinforced concrete structures

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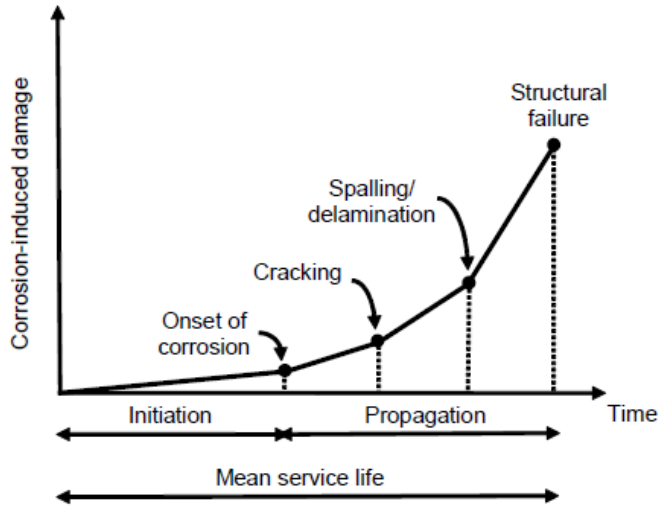
When exposed to aggressive environment, reinforced concrete structures are subjected to a degradation mechanism that affects their integrity. Among various environmental attacks, the corrosion of reinforced concrete structures is considered the most dangerous. The process is launched by the penetration of aggressive agents, precisely the chlorides into the concrete. The chlorides induce a localized corrosion, also called pitting corrosion, or a general corrosion called uniform corrosion. This corrosion phenomenon depends on several factors such as the materials characteristics, loadings, geometry and the environment. A physical model of steel corrosion in reinforced concrete occurs in two phases:

- The initiation phase is the phase during which chloride ions penetrate the concrete cover and reach the reinforced steel in sufficient quantities to depassivate it, therefore initiating the process of corrosion
- A propagation phase in which the active corrosion of steel decreases the strength of the element leading to its failure.



In this work, we propose a model for the time of corrosion initiation when the chloride concentration at the reinforcement level has reached the so called 'threshold value'. The length of the corrosion initiation time is controlled by the depth and quality of the concrete (permeability, cracking intensity), the presence of protective system, the rate of chloride ingress, the chloride concentration at the surface.