Updating of the corrosion degree based on visual data combined with strain or modal data

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Abstract

Many existing bridges are reaching the end of their technical service life. To estimate the remaining lifetime of reinforced concrete structures, it is important to assess the parameters of the corrosion process (i.e. parameters governing the corrosion propagation, but also parameters of the chloride or carbonation ingress). The level of corrosion and its spatial distribution can be inferred from strain data under static loading or modal data. In addition, information from visual inspections is often available as well, although not often used to quantify the level of corrosion. In this work, it is investigated how visual inspections can supplement the strain and/or modal data and provide information on corrosion parameters. The developed framework is applied to a simply supported beam subjected to corrosion.

Keywords: Corrosion; Bayesian updating; visual inspection; modal data; strain data; reinforced concrete

1 Introduction

In many countries, reinforced concrete structures are reaching the end of their technical service-life. Many of these structures are subjected to degradation, which is often related to corrosion of the reinforcement. To assess the remaining service life of these structures, it is important to estimate the actual corrosion degree and the parameters governing the initiation and propagation phase. Based on available monitoring information and information from visual observations, probability distributions of the corrosion parameters can be updated, inducing a more accurate estimate of the latter. This updating is performed by application of Bayesian inference according to Gelman et al. [1].

Vereecken et al. illustrate in [2]how the parameters of the corrosion model can be updated when including static and dynamic data in the likelihood function of the Bayesian updating procedure, i.e. by using strains measured under a static load and frequencies, mode shapes and/or modal strains extracted from dynamic measurements.

Besides the data from static or dynamic tests, very often also data from visual inspections is available. In this work, it is investigated how observations during visual inspections can supplement the above-mentioned data and influence the posterior distribution of the corrosion parameters.

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