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Probabilistic models for corrosion in structural reliability assessment

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For representation of material loss due to corrosion and for pitting corrosion in structural reliability estimation, appropriately accurate probabilistic deterioration models are required. These should account for the many variables involved in natural environments.

Recently introduced probabilistic phenomenological models for marine immersion corrosion are described both for general and for pitting corrosion. These show that the nature of the corrosion process changes from being controlled by oxygen diffusion and later by anaerobic bacterial action. This change has important implications for longer-term prediction of general corrosion loss and for maximum pit depth. Recent research in this area is reviewed. Also, a summary is given of the effects of steel composition, water velocity, salinity, pollution and season of first immersion.

Aspects of estimation of time - dependent structural reliability

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This talk will give an overview of the general structural reliability problem including loads as processes and compare this to the load combination problem required to be solved for use in design code formats. Of particular interest will be the issue of dealing with the time dependent reduction in resistance such as due to fatigue and corrosion. Up- and out-crossing analysis, asymptotic outcrossings and the first passage problem will be reviewed as concepts for dealing with this problem. An issue for some situations is the so-called ‘clumping’ of extremes.

Solution procedures to deal with these problems include enveloping, Monte Carlo simulation, conversion to a FOSM problem and so-called ‘fast probability integration’. Recent work includes efforts to estimate the error incurred in using the ensemble upcrossing rate approach. An on-going research effort that recasts the problem will be outlined also.