



Truss Structure Capacity Monitoring Considering Accelerated Steel Corrosion under Climate Change

Yansheng Feng

Department of Bridge Engineering, Tongji University, Shanghai, China

Zhi Sun

State Key Laboratory on Disaster Reduction for Civil Engineering, China

Contact: sunzhi1@tongji.edu.cn

Abstract

Taking steel corrosion model $d = At^B$ as the baseline material deterioration model, this paper investigates the influence of the variation of steel deterioration parameters on structure modal parameters and load carrying capacity. The sensitivity based inverse mapping problem is used to monitor the variations of steel deterioration parameters under varied climate conditions. Structure plastic limit analysis based on generalized mechanism generation method is adopted for the deteriorated structure capacity prediction. Numerical studies on a truss bridge are conducted. The results tell that the foregone normal climate change will not induce important bridge capacity degradation in its service life. The variation of modal frequencies can present the degradation of structural load carrying capacity considering the uniform steel corrosion of the whole structure.

Keywords: steel corrosion, plastic limit analysis, load bearing capacity, vibration monitoring.

1 Introduction

Steel corrosion is a main factor for steel truss structure condition and capacity degradation. If the corruptions on steel components due to climate change are considered, structure condition deterioration and capacity degradation will be accelerated.

Different damage scenarios have different effects on structural condition deterioration and vibration characteristics variation. For local damages, as the distribution is uncertain, its influence on the vibration performance is uncertain. For the global uniform deterioration on steel structure, some scholars proposes the degradation model of structure according to different types of environment condition^{1,2,3}.

For structure load bearing capacity computation, the generally adopted methods⁴ are: the method based on the investigation, the method based on the design specification, the method based on load test, the method based on expert experience

and the method based on reliability theory. Among them, the plastic limit analysis based evaluation method is of the greatest potential.

The main purpose of this study is to investigate the influence of the variation of steel corrosion parameters due to climate change on structure modal parameters and load carrying capacity for truss structures.

2 Method

2.1 Steel degradation model

Steel corrosion is a main problem which will induce the degradation of steel structure. The steel corrosion model used in this paper is presented as follows^{2,3}:

$$d = At^B \quad (1)$$

where A and B are deteriorate parameters, t is time and d is the corrosion depth ($10^{-6}m$).