

Structural Integrity Management of Steel Structures Subjected to High Fatigue Loading

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Abstract

The paper deals with an overall strategy employed by Maintenance Technology Institute of Monash University to manage structural integrity of the structural systems in large mining machinery that are subjected to high fatigue loading. The structural systems employed in these machines are predominately welded structures consisting of hot-rolled structural members with open or tubular profiles. The design of the overall systems as well as the members is often governed by stability and fatigue. Large proportion of these structural systems has already passed their initial design life and hence the management of structural integrity to ensure safety and reliability of operation is a significant technical challenge. The paper will discuss the overall approach employed and the main components of the management system. The methods used for setting up inspection schemes will be discussed. The methodology employs measurement of loading using structural responses and uses them to accurately estimate the loading for strength and fatigue design. Analysis of the structural system is undertaken using FE models which are calibrated using measurements. The critical members and connections for inspections are identified from analysis and measurements. Guidelines are provided to site staff to respond appropriately if defects are found during inspections. Some machines use permanently installed monitoring systems to increase the reliability and safety. Practical examples of how the structural integrity management system operates will be demonstrated using several examples of applications. The approach can be considered as generic and hence can be adapted to be used for steel structures such as bridges and other industrial structures subjected to significant fatigue loading.