Abstract

The current study is focused on the investigation of the failure case history pertaining to the in-service fractured steel pins of a chain assembly installed in a continuous cold drawing machine. The findings of the present investigation showed that the pins failed due to multiple-origin rotating bending fatigue under low applied load, due to the application of tensile and/or bending stresses, initiated from the pin circumference. The multiple-crack initiation is consistent to severe stress concentration conditions, as imposed by the low fillet radius attributed to the original pin design. No microstructural abnormalities were detected, that could have been correlated to the principal cause of failure. In the context of the present evaluation, analytical methods such as visual inspection, optical microscopy, SEM fractography and microhardness testing were utilized. Moreover, a finite element analysis of the assembled chain was performed in order to investigate the stress distribution during the operation of the chain and to formulate a sound quantitative approach which will assist in better understanding of chain/pin loading conditions. The primarily insufficient component design resulted in high stress concentration factors interacted with the soft annealed material used for the component and caused fatigue under the presence of fluctuating stresses.