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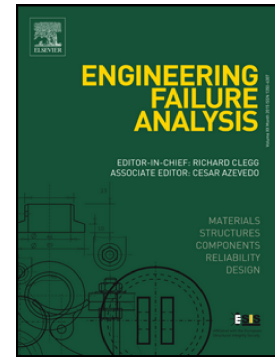
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Failure analysis of a nose landing gear fork

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Abstract

This paper presents a detailed analysis of a nose landing gear failure. The developed study comes following an accident occurred in which the nose of the landing gear's fork of a light aircraft failed during landing. According to Federal Aviation Administration, in average, 55% of aircraft failures occur during takeoff and landing.

In order to determine the causes of the accident, a material analysis was performed, followed by a detailed study of the fracture's surface both visually and using optical and scanning electron microscopies. It was observed that fatigue cracks developed in the vicinity of the bolted holes, which work as supporting connections, on the topside of the nose fork and, as such, it can be concluded that the referred area was subjected to cyclic stresses originating and propagating cracks in the material. This cracking is characteristic of the existence of stress concentration areas. Identified the crack initiation zone with ratcheting and beach marks near the origin of the crack, combined with the fact that the nose wheel fork is subject to cyclic loading, leads to the conclusion that the component failed due to fatigue.

Finite element analyses were also performed on the nose fork taking into account service conditions in order to assess the structural integrity of the component. During the analysis it was observed that the critical areas are located in the vicinity of the connecting holes, as it was observed in the fracture surface analysis. The assembly behaviour in the presence of four straight cracks, originating from the fork holes, was also studied using the stress intensity factors, calculated using the contour integral method.

Keywords: Aircraft landing gear; Nose wheel fork; Fatigue; Finite elements; Fracture surfaces.

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