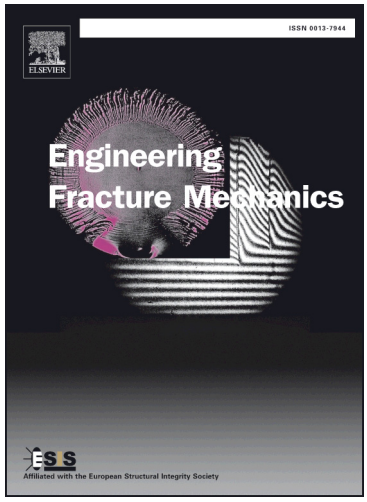

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H. Ghorbani, T.N. Chakherlou, H. Taghizadeh

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On the estimation of fatigue life in bolt clamped Al-alloy 2024-T3 plates

H. Ghorbani[a], T.N. Chakherlou[a], H. Taghizadeh[a,*]

[a]*The Faculty of Mechanical Engineering, University of Tabriz, P.O. Box 51666-14766, Tabriz, Iran*

Abstract

A numerical method has been used to predict the fatigue life of bolt clamped double shear lap joints. The employed method combines the initiation and propagation phases of the fatigue life without a prior definition of an initial crack length. Finite element analyses have been performed to obtain the created pre-stress field due to bolt clamping force. The calculated stress and strain distributions from the finite element analyses were employed to predict fatigue crack initiation life. To obtain the effective stress intensity factor for the estimation of fatigue crack growth life using Paris law, a weight function method was employed.

Keywords: Fatigue life, Bolt clamping force, Fatigue crack initiation, Weight function, Fatigue crack growth

1. Introduction

Bolted joints, as part of mechanically fastened joints, are the most common structural joints in commercial and aerospace structures. These joints are used despite their drawbacks, because of their low cost and simplicity of assembling. With increasing in the testing and experimentation of structural material, it becomes apparent that the majority of fatigue found in aerospace structures was located at specific components' regions where there are bolt holes, grooves. These areas exhibit a dramatic decrease in fatigue life during test due to an increased stress as a result of stress concentration. This stress concentration eventually causes early fatigue crack initiation and propagation. Regarding to fastener holes in components and bolted joints, several methods such as cold expansion [1,2], bolt clamping [3] and interference fit [4], have been used to improve the fatigue life of the components and the joints.

*Corresponding author. Tel.: +98 41 3339 2492.

E-mail address: h.taghizadeh@tabrizu.ac.ir (H.Taghizadeh).