

A SUGGESTED ANALYTICAL SOLUTION OF ORTHOTROPIC COMPOSITE PLATE STRUCTURE WITH CRACK EFFECT

¹MUHSIN J. JWEEG, ²ALI S. HAMMOOD & ²MUHANNAD AL-WAILY

¹Al-Nahrain University, College of Engineering, Mechanical Engineering Department, Baghdad, Iraq

²Kufa University, College of Engineering, Material Engineering Department, Najaf, Iraq

ABSTRACT

The existence of a defect like a crack will leads to change in natural frequency of the plate and enlargement of the crack will also lead another change in natural frequency with the change of the size or position of the crack. So this study focuses on finding the natural frequency for orthotropic composite plates with crack considering the size of the crack (crack length and depth through plate thickness) an crack position in the plate in x, y directions, also slant of the crack. The natural frequency is studied for composite material strengthen by long, and woven fibers with the effect of crack size and position, plate thickness, aspect ratio, the type of plate fixing where three type of fixing used (SSSS, SSCC, SSFF).

Two methods are used to find the natural frequency of composite plate: First method is supposed analytical solution to solve the equation of motion considering the effect of size, and position crack on the natural frequency of the composite plate. Second method is finite element solution using ANSYS (ver. 14) program. A comparison made between the two methods and the error percentage is not exceeds of 3.5%.

The results shows that the natural frequency decreases as crack size (length or width) increases. The natural frequency decreases when the crack in the middle of the plate over any position of the crack. The effect of crack when it reaches the middle is higher than when it's in the other places. The natural frequency is decreases as plate width increases, (aspect ratio and plate thickness).

KEYWORDS: Plate Vibration, Crack Study, Composite Plate with Crack Effect, Crack Plate Vibration