Numerical Modelling of Triangular Corrugated-core Sandwich Panel subjected to Impact Loading

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Abstract—In this paper, lightweight aluminium AL2024-O sandwich panels were tested using drop-weight impact tower with lateral impactor to evaluate impact responses and to identify the associated failure mechanisms under various impact loading conditions. The simulations of impact responses of triangular corrugated-core sandwich panels were presented, which were validated against the corresponding experimental data. The triangular corrugated-core sandwich panel configurations were studied by using commercial finite element (FE) code, ABAQUS/Explicit. The FE code is used to develop numerical models by using plasticity with strain hardening, and ductile damage criteria, etc., to cover the most representative cases. A good agreement was obtained, which indicates the finite element models developed are capable of predicting the dynamic behaviour of the triangular corrugated-core sandwich panels subjected to uniform lateral impact.

Keywords—corrugated-core; low velocity impact; finite element analysis; sandwich panel.

I. INTRODUCTION

Sandwich panels are considered as optimal designs for a wide range of engineering applications such as insulated structures, aerospace vehicles, marine constructions, etc. A composite sandwich panel is typically made from a lightweight foam, honeycomb or corrugated-core sandwiched between two composite skins. Such a combination offers exceptional specific strength-to-weight or stiffness-to-weight ratio, buoyancy, dimensional stability, and thermal and acoustical insulation characteristics. Recently, many researches have been study on various types of sandwich panels (Biancolini, 2005; Herrmann, Zahren, & Zuardy, 2005; Kazemahvazi & Zenkert, 2009; Lin, Liu, Kuo, & Chen, 2007; Nyman & Gustafsson, 2000; Rejab & Cantwell, 2013; Xiong, Ma, Wu, Liu, & Vaziri, 2011; Yokozeki, Takeda, Ogasawara, & Ishikawa, 2006; Zenkert, 1995; Zhang Y, 2011). However, it was found that few of published worked involved in triangular corrugated-core sandwich panels in spite of a versatile applications.

In this paper, the triangular corrugated-core sandwich panels made by bonding two cover sheets to the core material, consisting of triangular with angled at 45° formed sheet metal, were used, tested and modelled in order to study the influence of low velocity impact. Response of the sandwich panel was investigated by using the uniform lateral indenter.

II. EXPERIMENTAL SETUP

The triangular corrugated-core sandwich panels in this study were based on AL2024-O aluminium alloy sheets from fabricated by bonding two cover sheets into core material, which consists of triangular formed sheet metal, using adhesive bonding technique. Fig.1 shows a design and dimension of the sandwich panel.

![Fig. 1: Geometry of corrugated-core sandwich panel.](image)

Generally, the unit cell is based on a triangular profile. The geometric parameters plotted in Fig. 1 are annotated as follows: $\theta$ and $\beta$ are the internal angle of a unit cell for the