

Patinya Kumsantia 2010: An Experimental and Numerical Study of Metallic Insert in Sandwich Structures under Pull-out Test. Master of Engineering (Aerospace Engineering), Major Field: Aerospace Engineering, Department of Aerospace Engineering. Thesis Advisor: Assistant Professor Phacharaporn Bunyawanichakul, Ph.D. 69 pages.

The purpose of this research is to study the pull-out strength of metallic insert in composite sandwich structures. This type of insert is widely used in the attachment for helicopter skin which is commonly composed of Nomex<sup>®</sup> honeycomb core and carbon epoxy composite face skins. In general, the molded-in insert is used because of its ability to bond the insert, core and face skins into one rigid unit. Three types of insert form were numerically studied : through-the-thickness insert, non through-the-thickness insert and through-the-thickness insert with head. The results from finite element modeling have shown that the insert with head has lowest local stress comparing to the other insert types. The experimental study of metallic insert under pull-out test have shown that the failure initially occurred by buckling, folding and wrinkling of the honeycomb cell wall attributed to a transverse shear failure adjacent to the potting mass. However, the whole structures are still attached together and resist the load by the intact components. The last failure is the interfacial failure of potting/lower face skin and followed by a rapid rip of the honeycomb core attributed to a tension failure at the ultimate load. These failure mechanisms are investigated by specific test of each components and implemented into the finite element modeling. Good agreement with the experiment is observed by a slightly different of ultimate load about 3%.

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Thesis Advisor's signature