

**STEADY-STATE STRUCTURAL ANALYSIS ON COPPER AND GOLD  
WIRE BONDING USING ANSYS**

**SURAYA BINTI KHALID  
2009605172**

**FACULTY OF ELECTRICAL ENGINEERING  
UNIVERSITI TEKNOLOGI MARA  
MALAYSIA**

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## ABSTRACT

The aim for this analysis is to perform simulation and steady-state analysis in structural discipline on wire bonding for various forces and pressure loading on both copper (Cu) and gold (Au) materials. This analysis will consider the size, temperature and properties of each material which resulting the stress on structural. The features of the copper material such as much lower cost, high conductivity, high melting point and strong resistance make it an ideal choice for many new applications. The scope of this study includes the modeling of wire bonding, defining the geometries and properties of each material using finite element method. Simulation is conducted using software ANSYS Multiphysics in order to analyze the structural characteristics and the stress distribution of copper and gold wire bonding under thermocompression wire bonding process. This research focused on two parts; the free air ball and heat affected zone of the wire bonding structure. Results show that von Mises stress of gold wire bonding simulation is 1.25% than copper at pressure 300MPa while 9.1% difference at pressure 500MPa. For first principal, copper and gold show 6.45% difference at 300MPa and 9.35% difference at 500MPa.

*Keywords:*

— wire bonding, finite-element method, force, pressure, von Mises stress, first principal stress.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Wire bonding is the most popular interconnection method in semiconductor device packaging. There are three type of materials that been used as wire bonding which are Aluminum, gold and copper. The common material that used in wire bond process is gold which it has high conductivity to electricity. However the price of gold has been highly increased starting 2007 [3]. The IC packaging industries are now focused on copper wire as the replacement for gold wire.

Copper has been considerable material for wire bonding for its economic advantage, high conductivity, high melting point and strong resistance. Copper have an excellent conductivity which it have low resistance, its conductivity is up to 40% higher than gold [11]. There were lots of researches and studies that have been published on copper and gold wire bonding, but the continuous improvement of the materials refinery development and equipments is still needed.