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LIST OF SYMBOLS AND ABBREVIATIONS

A	-	Area
E	-	Modulus of elasticity
FEA	-	Finite element analysis
FEM	-	Finite element method
FR-4	-	Flame Retardant 4
g	-	Gravity
G	-	Acceleration peak
h	-	Height
I	-	Internal forces in the structure
ISO	-	International Standards Organization
JEDEC	-	Joint Electron Device Engineering Council
l	-	Length
M	-	Mass of the structure
P	-	Applied external forces
PCB	-	Printed circuit board
t	-	Time
$\ddot{u}$	-	Acceleration of the structure
v	-	Impact velocity
w	-	Width
σ	-	Stress
ε	-	Strain
μ	-	Poisson's ratio
ρ	-	Mass density

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

1.1 Introduction

Electronic products fit into the consumer and variable market segments around the world. Included in the electronic products are computers, digital cameras, calculators, mobile phones, pagers, palm size PCs, smart cards, personal digital assistants (PDAs) and other electronic products. Reliability of these products has become a major concern recently.

These electronic products have the tendencies to being dropped during transportation or customer usage that may cause failure, which leads to malfunction of the products. This dropping event not only caused mechanical failures in the housing of the device but also create electrical failures in the printed circuit board (PCB) assemblies mounted inside the housing due to transfer of energy through PCB supports. The failure mechanism may result from various failure modes such as cracking of circuit board, trace cracking on the board, cracking of solder interconnections between the components and the board, and the component cracks. The primary driver of these failures is excessive flexing of circuit board due to input acceleration to the board created from dropping the electronic product. This flexing of the board causes relative motion between the board and the component mounted on it, resulting in component, interconnects, or board failures. The failure is a strong

function of the combination of the board design, construction, material, thickness, and surface finish; interconnect material and standoff height; and component size. Therefore, it is important to design a more robust package and board with better reliability performance due to drop impact.

This project will focus on the dynamic response of a desktop computer's motherboard. For this investigation, the parameters that will be considered are effect of drop orientations and placement of package on the motherboard under the impact loading.

1.2 Objectives of This Study

Dynamic response of motherboard are crucial because they reflect the mechanical behaviour of motherboard, which are closely related to the material properties during drop impact. Before its application as a main component in the computer, it is important to understand its dynamic response as this will affect all the components within the motherboard; solder balls, package and die and to have a modeling tools for simulating the response of the motherboard under the impact load.

Dynamic response in this study is focused on the manner of the motherboard during the impact and after the impact. It also concern the stress propagation in the PCB and acceleration at a selected point in the finite element model. The objectives of this study are:

i. To predict a dynamic response of a computer's motherboard under drop impact loading condition using Finite Element Method (FEM).

ii. To evaluate the state of stresses in the solder balls interconnection which are connect the electronic package to the PCB.

iii. To investigate the effects of drop orientation and package placement on the dynamic response of the motherboard and the state of stresses in the solder ball interconnection.

1.3 Scopes of Study

The aims of this study is to identify dynamic phenomenon in term of free fall drop by modeling the component using the finite element method. The scopes of this study are :

i. Modeling the portion of a motherboard that consists of microelectronic package that is attached to the PCB using solder balls interconnection.

ii. Performing drop impact simulation based on specifications obtained from Joint Electron Device Engineering Council (JEDEC) Standard.

iii. Commercial finite element software is used to model the board and simulate the drop transient of the motherboard from 1 meter height.

iv. Assess the effects of drop orientations of 45^0 and vertical 90^0 relate to the floor and package position at the centre, upper and lower of the motherboard.

1.4 Research Questions

Generally, there are some problems that still remain untouched previously. The problems are:

i. For a given electronics product, how severe would the dynamic loading be in a typical drop impact, and how will the motherboard as a whole respond to the drop impact load?

ii. How will the impact load be transmitted to the electronic package attached to the motherboard?

iii. What would be the state of stresses in the solder balls connects the package to the PCB?

1.5 Rational and Assumption of Study

Before this study is done, there are some rationals and assumptions condition that are used to justify the significant of this work. There are :

i. Motherboards are more prone to being accidentally dropped during transportation and during services. Normally, motherboard is designed to withstand drop to floor.

ii. Drop impact can cause excessive bending of the PCB leading to cracking, and also failures of solder balls interconnection between packages and the motherboard. In this event, the reliability of that product becomes the major concern by the consumer.

iii. Performing actual drop test is quite difficult due to the facilities are very expensive which require high speed camera and sensors. Then, labor extensive need to consider because it requires a lot of manpower in measurement and failure analysis. Not all labor can setup the experiment procedures. Beside that, the experimental setup and analyze data consume a lot of time due to difficulty of that works. That is why experimental work is not included in this work.

1.6 Summary Outline

Chapter 2 provides a review of the literature related to the aims and scope of this study. Topics reviewed include material properties, standard procedure requirement, analysis of few research works and publications related to drop test and simulation of its solder joint realibility.

Chapter 3 describes the steps that are used to develop the finite element model. Techniques to simulate dynamic impact loading conditions also covered in this chapter. Development of an appropriate material model for the motherboard will discussed detail in this chapter.

Chapter 4 performs an analysis of the dynamic response with the various input parameters involved under drop impact loading. The parametric study examines the relative effect of various geometry parameters on the impact loading condition and dynamic response of the motherboard.

Chapter 5 discuss the results of analysis done using FE model developed in Chapter 3. The findings are used to make the conclusions for overall results and finally summarises the main conclusions of this research and for the future applications. Also include about the recommendation to improve and extends this study later on.

DESIGN AND DEVELOPMENT OF A PORTABLE ONION PEELER MACHINE

NAZRUL HAMIZI BIN ADNAN

A project report submitted in partial fulfilment of the
Requirements for the award of the degree of
Master of Engineering (Mechanical)

Faculty of Mechanical Engineering

MAY 2010

DEDICATION

First of all, all the praises and thanks be to Allah S.W.T for His Love,

This thesis is dedicated to my family,

To my beloved wife SALIZAWATI BTE ABDUL SAMAD, mother ZAINAB BTE MD ZIN, father ADNAN BIN MASRI, mother in law HJH PUZIAH BTE AHMAD, father in law HJ ABDUL SAMAD BIN HJ HASHIM brothers and sisters

NORAZILAH BTE ADNAN

SAIFUL HASIDI BIN ADNAN

ZULHELMI BIN ADNAN

NORHIDAYAH BTE ADNAN

MOHD SYAHRIN BIN ADNAN

MOHD KHAIRUL IZUAN BIN ADNAN

With bless his soul and not forgetting ASHRAFF NAUFAL my son.

ACKOWLEDGEMET

I would like to thank Allah Almighty for blessing me and giving me strength to accomplish this thesis. In particular, I wish to express my sincere appreciation to my project supervisor, Assoc. Professor Dr. Izman Bin Sudin from Universiti Teknologi Malaysia for encouragement, guidance and critics. My sincere appreciation also extends to all my colleagues and others who have provided assistance at various occasions.

ABSTRACT

Construction of onion skin peeling machine is designed to meet the standards required by the customer or user. This machine is designed according to standards of Boothroyd Dewhurst in design and innovation for a machine. In general machine construction methodology is based on the concept of friction on the surface of the onion and topped with the use of water to helps soften the surface of the onions before peeling process can be done. Meanwhile, the methods and the use of machines is based on the rotation of a soft brush attached to the shaft and fully controlled by a single phase AC motor. This process is expected to make onion skin come out. This machine is build to meet the demand from small-and medium industry in design, function, and price. This machine is also expected to be used for wedding fest preparation in the villages. Efficiency of this machine had been measured and the data are being analyzed using Design Expert software for the ANOVA procedure.

ABSTRAK

Pembinaan mesin pengupasan kulit bawang ini adalah bertujuan untuk memenuhi piawaian yang dikehendaki oleh pelanggan ataupun pengguna. Mesin ini direka mengikut piawaian Boothroyd Dewhurst dalam merekabentuk dan pembaharuan untuk sesebuah mesin. Secara amnya metodologi pembinaan mesin ini adalah berlandaskan konsep geseran terhadap permukaan bawang besar dan ditambah lagi dengan kaedah penggunaan air dalam membantu untuk melembutkan permukaan bawang sebelum proses pengupasan boleh dilakukan. Sementara itu, kaedah dan penggunaan mesin adalah berlandaskan proses putaran berus lembut yang dipasang terhadap shaft dan dikawal sepenuhnya oleh single phase AC motor. Proses ini dijangkakan mampu membuatkan kulit bawang terbuka. Mesin ini direkabentuk agar dapat memenuhi permintaan dari industri kecil dan sederhana melalui rekabentuknya, fungsinya, dan harganya. Mesin ini juga diharapkan boleh digunakan untuk majlis perkahwinan di kampung-kampung. Tahap efisien mesin ini juga akan diukur dan data akan dianalisa menggunakan perisian Design Expert bagi prosedur ANOVA