FINAL PROJECT

NUMERICAL STUDY OF CRASH BOX UNDER IMPACT LOADING TO ABSORB ENERGY OF COLLISION FOR VEHICLE USING MSC DYTRAN SOFTWARE

Submitted to The Mechanical Engineering Department of Universitas Andalas in Partial Fulfilment of The Requirement for The Graduated in Mechanical Engineering

By:

ABDEL AZIZ

ID: 1610911056

MECHANICAL ENGINEERING DEPARTMENT

ENGINEERING FACULTY - UNIVERSITAS ANDALAS

PADANG, 2022

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FINAL PROJECT

The final project as one of the requirements to complete a Bachelor of Engineering Education at the Department of Mechanical Engineering, Faculty of Engineering, Universitas Andalas, is given to:

Name	:	**Abdel Aziz**
Student ID	:	**1610911056**
Supervisor	:	**Dr.Eng. Eka Satria**
		Dr.-Ing. Jhon Malta
		Prof. Dr.-Ing. Mulyadi Bur
Time Completion	:	**± 12 Months**
Title	:	**Numerical Study of Crash Box Under Impact Loading to Absorb Energy of Collision for Vehicle Using MSC Dytran Software**

Final Project Description:

1. **Literature Review.**
2. **Design of crash box with several trigger**
3. **Simulation study of crash box on Msc Patran & Msc Dytran software**
4. **Analysis and Discussion**
5. **Conclusions**

Padang, January 2021

Supervisor	**Co-Supervisor**	**Co-Supervisor**
Dr. Eng. Eka Saria	**Dr.-Ing. Jhon Malta**	**Prof. Dr.-Ing. Mulyadi Bur**
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APPROVAL FORM

NUMERICAL STUDY OF CRASH BOX UNDER IMPACT LOADING TO ABSORB ENERGY OF COLLISION FOR VEHICLE USING MSC DYTRAN SOFTWARE

By:

ABDEL AZIZ

ID: 1610911056

Submitted to the Mechanical Engineering Department of Universitas Andalas in Partial Fulfillment of the Requirements for the Degree of Bachelor (S1)

Padang, January 2022

Approved by

Supervisor	Co-Supervisor	Co-Supervisor
Dr. Eng. Eka Satria	Dr.-Ing. Jhon Malta	Prof. Dr.-Ing. Mulyadi Bur
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INTEGRITY PACT

I am who undersigned with this declare that

i. The final project entitled " Numerical Study of Crash Box Under Impact Loading to Absorb Energy of Collision for Vehicle Using MSC Dytran Software" is entirely the result of my work. It has been primarily composed and fully implemented by utilizing all the facilities and infrastructure at Structural Dynamics Laboratory, Department of Mechanical Engineering, Universitas Andalas, since August 2020 under the guidance, support and help of Dr. Eng. Eka Saria, Dr.-Ing. Jhon Malta and Prof. Dr.-Ing. Mulyadi Bur.

ii. Things that are not my work or I quote and take from other sources have been declared and specified by ordinance citations.

iii. All result of this study belongs to Structural Dynamics Laboratory, Department of Mechanical Engineering, Universitas Andalas and further use of the outcome of this study follows the rules and ethics.

iv. Thus, Integrity Pact I made with the truth. Suppose there is incorrect information in the future. In that case, I am willing to be charged in court and ready to accept any action taken by Universitas Andalas.

Limau Manis, January 2022

Abdel Aziz

1610911056

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

"1. Did We not expand for you, (O Muhammad), your breast?. 2. And We removed from you your burden. 3. Which had weighed upon your back 4. And raised high for you your repute. 5. For indeed, with hardship (will be) ease. 6. Indeed, with hardship (will be) ease. 7. So when you have finished (your duties), then stand up (for worship). 8.And to your Lord direct (your) longing." (QS. Al-Insyirah, 1-8)

I dedicated this research as a sincere devotion to

My beloved mother, Dewi Chandra S.Pd, and My beloved father, Mulyadi,

who always prayed for me, and giving their immortal love to me.

My brother, Sulthan nika de sidik, A.Md, Mustaqim and Abdul hamid

My sister, Assyifa Delya, S.Pd, Rahmania Ulfa, S.Pdi, Fitri Malini, and Rahmi Rizkia Putri which has been giving for all prayers and encouragement

Sincere acknowledgments to all of my Lecturers,

my teachers, for knowledge and education

that are given to me, may it become righteous deeds

in the sight of Allah SWT, Aamiin

To

all my friends (M29), my senior, and my junior mates in Mechanical Engineering Department

Structural Dynamic Laboratory Assistant

members of buk idel's rent house

Finally, may all the knowledge that I have gained be useful for me, My religion, My family, My country Indonesia, and all of the people around the world.

UNIVERSITAS ANDALAS
KEDJAJAAN UNTUK BANGSA

ABSTRACT

Based on WHO data, one of the biggest contributors to the death number is traffic accidents. For reducing this number, vehicle safety was created, such as seatbelts, antilock braking systems, airbags, crash box. A crash box is a thin-walled structure that is useful for absorbing collision energy. The magnitude of the energy absorption is affected by the material, load and geometry. Many kinds of research on Crash Box aims to determine the best model for the greatest energy absorption. This final project discusses the trigger effect and velocity on energy absorption by the crash box. The crash box models are straight beam and S-beam. The trigger models of the straight beam crash box are the non-trigger, 2-folds, 2-hole, 5-folds and 5-hole, while the s-beam trigger models are the non-trigger, v trigger and cross-section trigger. The velocity variations given are 0.2 m/s, 0.02 m/s and 0.002 m/s. The analysis of the crash box uses a finite element model where MSC Patran and MSC Dytran conduct the modelling and analysis. From the analysis that has been carried out, the results of the crash box models are efficient in energy absorption. The best trigger model for the straight beam is the 2-fold trigger model with energy absorption 4165.32 J. The s-beam crash box trigger model is the best trigger V model with energy absorption 23756.80 J. The results of the velocity variations analysis are also obtained the amount of energy absorbed by the crash box has no significant difference for each velocity variation.

Keywords: *crash box, trigger, energy absorbed, straight beam, s-beam.*