UNIVERSITI PUTRA MALAYSIA

FATIGUE CHARACTERISTIC OF AUTOMOTIVE JOUNCE BUMPER

RAJDAVE SINGH SIDHU

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FATIGUE CHARACTERISTIC OF AUTOMOTIVE JOUNCE BUMPER

By

RAJDAVE SINGH SIDHU

Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in fulfillment of the requirements for the Degree of Master of Science

December 2010

DEDICATION

I would like to thank my beloved parents Bachitar Singh and Kashmir Kaur, my brother Hardave Singh and the love of my life Jagdeesh Kaur for their patience and support during the preparation of my thesis.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia
in fulfilment of the requirement for the degree of Master of Science

FATIGUE CHARACTERISTIC OF AUTOMOTIVE JOUNCE BUMPER

By

RAJDAVE SINGH SIDHU

DECEMBER 2010

Chairman : Associate Professor Aidy Ali, PhD

Faculty : Institute of Advanced Technology

Most rubber components in the automotive industry are subjected to static and dynamic loading. Research on fatigue analysis and ways to enhance fatigue life is constantly done as it's directly related to the safety and reliability of a product. Fatigue life determination carried out experimentally has the best accuracy however these methods are not feasible when the components are constantly being renewed. The study was done on an automotive rubber jounce bumper with a rubber hardness of 60 IRHD. The test was conducted in displacement controlled environment under compressive load. The compression test reveals that the jounce bumper is able to withstand a maximum force of 7 KN. The fatigue life of the rubber jounce bumper was successfully determined at three zones by separating the safe zone from the potential danger zone. The existing models by Kim, Harbour, Woo and Li were used to compare and validate the fatigue life. The SEM result shows the existence of decohesions in the control jounce bumper.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

SIFAT KELESUAN BUMPER GETAH OTOMOTIF

Oleh

RAJDAVE SINGH SIDHU

DISEMBER 2010

Pengerusi : Professor Madya Aidy Ali, PhD

Fakulti : Institut Teknologi Maju

Sebahagian besar komponen getah dalam industri otomotif dikenakan pembebanan statik dan dinamik. Analisa kelesuan dan cara-cara untuk meningkatkan jangka hayat komponen giat dilakukan untuk memperbaiki tahap keselamatan dan kebolehpercayaan produk. Pengujian tahap kelesuan komponen secara eksperimen mempunyai ketepatan paling tinggi dan harus diaplikasi untuk mendapatkan keputusan yang tepat. Kajian ini menggunakan bumper getah otomotif dengan tahap kekerasan getah 60 IRHD. Ujian dilakukan dalam persekitaran yang terkawal menggunakan beban mampatan. Ujian mampatan menunjukkan bumper getah mempunyai kekuatan maksimum 7 KN. Kelesuan bumper getah berjaya diperolehi dan boleh dibahagikan kepada tiga zon. Model-model yang dihasilkan oleh Kim,Harbour,Woo & Li telah digunakan untuk tujuan perbandingan dan menguji keupayaan model untuk mendapatkan nilai kelesuan yang paling hampir dengan nilai experimen. Ujian menggunakan pengimbas miroskop elektron (SEM) mendedahkan kewujudan ‘decohesion’ di dalam bumper getah.

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I would also like to thank my friends Syazwan Abdul Samad, Asmawi Sainnudin, Mohd Khairol Azhar, Mohd Faisal Badry and Mohd Hakim Abdullah who made my stay at UPM a memorable one.

I certify that a Thesis Examination Committee has met on 23rd of December 2010 to conduct the final examination of Rajdave Singh Sidhu on his thesis entitled "Fatigue Characteristic of Automotive Rubber Jounce Bumper" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science Automotive Engineering.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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RAJDAVE SINGH SIDHU
Date: 23 December 2010

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