MME-Converter and MME-Report for LS-DYNA[®] Users

Seung Hun Jeong

10DR KOREA Co., Ltd. #1505, 105 Jungdae-ro, Songpa-gu SEOUL (Garak ID Tower, Garak-dong) KOREA

Abstract

This paper will focus on the main features, benefits and use of MME-Converter and MME-Report which could be highly useful to LS-DYNA users for vehicle crash test analysis. With MME-Converter users can simply convert LS-DYNA result files, such as nodout, elout, deforc and rcforc to MME-filtered files through the auto-syntax analysis and then compare these converted MME-filtered files to real vehicle crash test data. The conversion of LS-DYNA files is carried out in accordance with the international occupant protection criteria including KNCAP, USNCAP, Euro NCAP and IIHS. Furthermore, MME-Report which is one-page reporting system using MMEfiltered data helps users to create concise, professional engineering reports, so that engineers in CAE teams, could share the test results with each other and even use them for formal meetings or presentations.

Introduction <MME-Converter>

MME-Converter is one of the modules of DynaX that converts LS-DYNA result files, mainly nodout, elout, deforc and rcforc, into MME-filtered files. In other words, LS-DYNA result files are used as an input file for MME-Converter and its output is an MME-filtered file which includes channel files. Prior to the conversion, users can modify the default properties of Channel and MME files, and after the property change it converts according to NCAP protection criteria in frontal, MDB side and pole impact.



Figure 1. Concept of Converting Process in MME-Converter

Benefits

- Conversion from LS-DYNA result files to ISO-MME files without any data loss
- ISO-MME format, an international standard, is used (Broader Accessibility and Sharing)
- Intuitive and straightforward user interface (No hassle to learn how to use)
- Customization is available (Users could add more items for NCAP or regulations)

Main Features and Usage

MME-Converter is so easy, user-friendly software with a straightforward interface that any user can readily understand all the features in a short time. The procedure for converting does not require an in-depth tutorial, but a series of simple steps to follow. In this paper, the main features of MME-Converter are described in the same serial order as the usage, and therefore none of basic tutorials are given.

MME-Converter has an export file filter for MME format. MME is the abbreviation for Multimedia Data Exchange Format for Impact Tests and its technical specification is ISO-TS 13499 which defines a directory structure and the exchange information as ASCII files. This format presents a simple way to exchange multimedia data of impact test between different laboratories. MME-Converter consists of five different sections (Refer to Figure2): Setting Directory, Test Setting, Lond and Dummy Case, Output and Progress. First, in Setting Directory, users set the location where to bring LS-DYNA result files from and where to store the output files of MME-Converter on the computer. In Test Setting, users change the default properties of a MME file including channel files.

MM .	EConverter	A. Setting Directory
A : I:\Company\10DR\GM Project\ISO_M	NE_Converter_DataWFrontalWENCAP_Offset_Frt_Drv_50M	Set the default 'open file' location (LS-DYNA)
ISO-MME : C:\Users\Udr\Ubesktop		Set the default 'save file' location (ISO-MME)
Channel file Refe	ence Number : DEFAULT_MODEL_NAME	b. Test Setting Change and apply the default information of
øect Case oad Case :	Dummy Case :	ISO-MME and Channel files
contral UDB de Gree NCAP Full Frontal Gree NCAP Fontal ODB Gree NCAP Side MDB US NCAP Side POle US NCAP Side MDB US NCAP Side MDB EURO NCAP ODB EURO NCAP ODB EURO NCAP Side MDB	H35U_KV H305_PSG H305_PSG ES2_DRV ES2RE_DRV SIDIIS_PRV SIDIIS_PRV SIDIIS_PSG IIH5_SIDIIS_PSG	C. Load and Dummy Case Select and apply one of the NCAP standards to LS-DYNA result files
utput		D. Output
).]		Display the success in conversion from LS-DYN/ to ISO- MME file and the list of converted files
Progress :	0%	E Program
		E. Progress

Figure 2. The Main Elements of MME-Converter UI

In a Channel and MME file, there is all the necessary information for road vehicle safety test, such as test object number, channel code, unit, direction, etc. and users can edit each property and apply it to all channels and MMEs at once. 'Figure3' indicates all the properties used in the Channel and MME file.

	Inform	ation	-	. 🗆 X				
File								
1 2	Data format edition number : Laboratory name :		Set Channel Information					
3	Laboratory contact name :		Transducer ID		^			
4	Laboratory contact phone :		Transducer Polarity					
6	Laboratory contact email :		Pre-filter type	N				
7	Laboratory test ref. number :		Channel frequency class	6 pole Butterworth				
8	Customer name :		Cut off frequency	CEC 1000				
9	Customer test ref. number :		Channel amplitude class	4000Hz at -3dB				
10	Customer project ref. number:		DAS Full Casta	1070 17				
11	Customer order number :		DAS Full Scale	1976.17				
12	Customer cost unit :		Reference channel	1978.17				
13	Customer test engineer name :		Reference channel name	implicit	~			
14	Customer test engineer phone:			1				
15	Customer test engineer fax :							
16	Customer test engineer email:							
17	Title :							
18	Timestamp :							
19	Type of the test :			OK	Cancel			
20	Subtype of the test :			ÖK	Concer			
21	Regulation :							
22	Reference temperature :							
23	Relative air humidity :							
24	Date of the test :							
25	Number of test objects :			~				
<				>				

Figure3. List of Properties in a Channel and MME File

MME-Converter provides a function called 'Auto-Highlighting Dummy Case.' Each load case is linked with dummy cases, so it automatically highlights a dummy case that is used for NCAP test protocal if one of the load cases is slected. However, users can manually select dummy cases for a certain road vehicle crash test. In Figure 4, ES2_Driver is highlighted when KNCAP Side Pole is selected.

			MMEConverter		
Setting Direct LS-DYNA : ISO-MME :	ory H:₩Comp C:₩Users	any₩10DR₩GM Projec ₩10DR-Jeong₩Deskto	t₩ISO_MME_Converte p	er_Dat	ta\Frontal\ENCAP_Offset_Frt_Drv_5
MME fi	e	Channel file	Reference Numbe	r:	DEFAULT_MODEL_NAME
IIHS Frontal (IIHS Frontal (IIHS Side Korea NCAP Korea NCAP Korea NCAP Sid US NCAP Sid US NCAP Sid EURO NCAP Sid EURO NCAP CONCAP SID	DDB Full Frontal Side MDB Side Pole Frontal e MDB e Pole ODB Side MDP	3		Dumn H350 H305 H305 ES2 ES2 SIDII SIDII IIHS IIHS	my Case : D_DRV D_PSG 5_DRV 5_PSG DRV RE_DRV IS_PSG SIDIIS_DRV S_IDIIS_DRV _SIDIIS_PSG
Progress :			0%		
Reference.			Start		Stop Close

Figure4. Selection of Load Case

The conversion process is displayed in both Output and Progress sections, so that users can find out the status of the conversion, success or failure. After clicking the start button in Progress section, the parsing process starts to convert LS-DYNA result files, such as nodout, elout, deforc and rcforc, with a progress bar.

Output	Output
>> nodout parsing ended	RUNNING Convert LS-DYNA TO ISOMME
>> elout parsing started	>> nodout parsing started
>> elout parsing ended	*Error : Channel C:\Users\10DR-Jeong\Desktop\channel\DeFAULT_MODEL_NAME.008 writing fail.
I>> deforc parsing started	>> nodout parsing ended
`'	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Figure 5. Indication of Conversion Process

After the successful conversion a 'Channel folder and MME file' are created in the save directory where a user set before. Channel and MME files can be loaded in Microsoft Excel and it shows the information on road vehicle crash test. Channel Code is found in a converted channel file. It is composed of a sequence of codes with a fixed length and specific order, defining test object, position, main location, fine locations, physical dimension, direction and filter class.



Figure6. Completion of the Conversion

Example: 1 1 HEAD	LE 00 H3	ACXA		
	1	= Test Object		Vehicle No. 1
	1	= Position		Front Left
	HEAD	= Main Location		Dummy Head
	LE	= Fine Location 1		Center of Gravity
Channel Code:	00	= Fine Location 2	Meaning:	Undefined
	Н3	= Fine Location 3		H III Dummy
	AC	= Dimension		Acceleration
	X	= Direction		X-direction
	Α	= Filter Class		CFC 1000

Table 1. Interpretation of Channel Code

Introduction <MME-Report>

MME-Report is one-page reporting software using MME-filtered data as an input file. It provides users with an easy way to create concise, professional engineering reports which display the value of dummy injuries and NCAP ratings. So users can easily share the reports with others, especially when collaborating on projects. In addition, it is highly useful for formal meetings where users need to deliver effective and professional presentations.



Figure 7. Work Flow of MME-Report

Benefits

- Create professional engineering reports with dummy injury measures and NCAP ratings
- Use the reports at formal meetings and presentations for the management or clients
- Export the reports in Excel format (Broader Accessibility and easier Sharing)
- Intuitive and straightforward user interface (No hassle to learn how to use)
- Customization is available (Users could change the rules and regulations)
- Make it easier to share results with colleagues and communicate clearly

Main Features and Usage

MME-Report is mainly designed to provide users with one-page engineering reports which are used to compare multiple MME-files and share the results of road vehicle crash tests with each other. The procedure for creating multiple reports does not require a complicated tutorial, but a series of simple steps to follow. Users could edit the formula for the properties of NCAP standards and configure graph elements. Ultimately MME-Report create an ideal environment for users to compare and analyse multiple MME files according to NCAP standards using charts and tables. As MME-Report can exports a completed report in Excel format, it allows users to sort out or filter the exported data effectively.

MME-Report consists of four sections (Refer to Figure8): Main Menu, Project Window, Load Case Table Panel, Multi-Chart Panel. First of all, in Main Menu users select one of NCAP standars, such as IIHS Side Driver, KNCAP Full Driver, ENCAP Front Offset Passenger, etc. And then the table for the selected load case appears on Load Case Table Pannel, showing the occupant protection criteria. Secondly, an MME-filtered file obtained from MME-converter is imported to compose a table with injury measures and NCAP ratings.



Figure 8. The Main Elements of MME-Report UI

In Project Window, the imported MME-file including channel files is displayed as a directory structure. Each channel file can be dragged and dropped into any chart, so that users precisely compare multiple channel files at a glance. When exporting these charts to Excel, One or multiple charts can be exported (Optional).



Figure 9. Drag-and-Drop the Channels to the Charts



Figure 10. Export the Channel Data to Microsoft Excel

Protection point and injury rating are highlighted in different colour. <Figure 11> shows IIHS Frontal Crash Results with scores and ratings. Here green means good and yellow means acceptable injury rating.

£ .	HOME	INSERT	PAGE	LAYOUT FORMUL	AS DA	TA	R	EVIEW	VIEV	V Je	ong	sign
8	Arial		- 9	• = = •	General	•		Condi	tional Fo	rmatting	- 1	4
	8 I	<u>u</u> -	A' A'	百百百日 日 -	🐨 - %		1	Forma	et as Tabl	e T	A	F. 414
e st	FE -	3.1		· # # ??.	22 .02		100	0419	Mest		Cells	Editing
board	*	Pont		ra Alignment ra	Number	- 14			Style1			
í.	· •	20	V fe									
в	D	E	F	с н і .	KL	м	ħ	0 0	2. R	Ť	w	K Y
		IIHS Fr	ontal Cr	ash Results	_					FOR 1	IGHWA	SAFET
Test No.	mber				- (1				NULL MORTH	GLEDE PORD A	A PACIFICAL VALUE
Test Ve	Nde				- 💌		-			ware particular	ar the real of	the sea
Test Sp	eed					22	22					
Test Da	ie :				Over	all Ra	ting					
Vehicle	Vieight				- 1	3000	,					
Engine	8 T/M											
KOELD-BA	ts system				_	_	-					
Con	powert	Regita	N/11/6 Do	wegtade Denormalie	0-A	A-8	8-5	Unt	NUV	Rating	Seb Rates	Total Rat
			HC15*		960	100	80		426.2	Good		
			Dowegrack	Hard Colactor Invad *					786			
		Head		Red & Bat Pela Acc.			- 10	9	842			
				Occured Time of Resistant Peak An	o.*			840	0.7550	0.04	Acception	
				Occare Start Take of HIC 15			840	0.9076	14 -			
				Occand End Title of HIC 15				540	07226			
	Head		NI-Tearte	Diama Ka	80	1	12	•	0.15	Good		
	& Net		NI-TRAFES	J RIKe	80	1	12		0.32	Good		Acceptable
	NHC8		NI - Conpre NI - Conpre	tation_Ethicks	0.5	1	12	•	D.D4	Good		
		100003		nika jikita	04_fields 0.0 1 12 - 0.00		Good	<u> </u>				
		Neck	Autor Teatice		26	33	4	LN .	10	Good	Creat	
			Autal Compile	cooperative rade <u>Par Glean</u> - by Neck Silear Dr		32 4 01080+C10e		15	6.9	Good		
			bowegrade					-				
				FE TEN KN - Dy Neck Te	ance Decisio C	the DeCan	1	-				
			Thursday Carl	Productive Tex City	eperie rea			-		Gend		
Injury			Sternen Det	in Annual and Cap		60	15	~	264	Good		
Rating	Chest	Clest	Sternen Der	ective Rok	66	82	95	8.8	0.00	Good	Gast	Good
	_		VIDOONE CITI	itta	0.8	1	12	8.8	0.07	Good		
			Female Auber	fotoe	73	7.3 51 109 10 02 000	Good					
			TEQ-Fent	Displacesent	12	15	=	-	0.7	Good	1	
			TED bot -	Upper	0.8	1	12		0.47	Good	1	
	LeftLeg	Lefting	TEO bar-	Lines	0.8	8 1 12 - 0.42 0000	0,000	Good				
	Poot		The Aug force			٤	1	EN .	2.5	6008	1	
			Peiner August	Force - by fem et Aulai Force Decator	Cam			8	1	Good		
		In the second	FootAcce & C	itten	190	20	20	9	67.6	Good	0,000	
		METOR.				_	_					
		all root	Femal Adde	force	61	9.1	129	10 11	10 1	0.000		
		all role	FenerAlbel TBD - Fener	force I Displacebe et	12	9.1 15	109 11	88	10	6000 6000		

Figure 11. One-Click Export to Microsoft Excel

Conclusion

MME-Converter and MME-Report have been developed to help LS-DYNA users who usually deal with a vehicle crash test analysis. MME-Converter is used to convert LS-DYNA result files to ISO-MME files without any data loss, and MME-Report used to create professional engineering reports with dummy injury measures and NCAP ratings. Their intuitive and straightforward user interfaces make it easier to learn without any difficulty. In addition, it gives broader accessibility to be shared with others by using a common file format, for example ISO-MME and Excel files. It is strongly recommended that both software should be used together for the purpose of the compatibility and improvement in work efficiency when the vehicle crash test analysis is being carried out.

References

[1] Indian Institute of Technology Delhi (2011), Crash and safety Overview, [Online] available from: web.iitd.ac.in/.../11-Crash_Safety_practices.pdf [accessed: 9th March 2014]

[2] ISO (2014), ISO/TS 13499 Road Vehicles – Multimedia data exchange format for impact test, [Online] Available from: http://www.iso-mme.org/ [Accessed: 9th March 2014]

[3] National Instruments (2004), DIAdem Basics Course Manual, [Online] Available from: bryzi.files.wordpress.com/2008/09/diadem-basics.pdf [Accessed: 10th March 2014]

[4] NHTSA (2005), Child Passenger Fatalities and Injuries, based on Restraint Use, Vehicle Type, Seat Position, and Number of Vehicles in the Crash, [Online] Available from: www.nhtsa.gov [Accessed: 10th March 2014]