

Knowledge Base

Information



Plug-in utility for computing Head Injury Criteria in Abaqus/Viewer

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QUESTION Can Abaqus compute the Head Injury Criteria from my crash analysis?

ANSWER (The following applies to Abaqus Version 6.6 and later)
An Abaqus/Viewer plug-in application for this purpose is attached below.

Installation

To install the plug-in, save the attached archive file to one of the following directories:
abaqus_dir\abaqus_plugins where *abaqus_dir* is the Abaqus parent directory
home_dir\abaqus_plugins where *home_dir* is your home directory
current_dir\abaqus_plugins where *current_dir* is the current directory

Note that if the *abaqus_plugins* directory does not exist in the desired path, it must be created. The *plugin_dir* directory can also be used, where *plugin_dir* is a directory specified in the *abaqus_v6.env* file by the environment variable **plugin_central_dir**. You can store plug-ins in a central location that can be accessed by all users at your site if the directory to which **plugin_central_dir** refers is mounted on a file system that all users can access. For example, `plugin_central_dir = r\\fileServer\sharedDirectory'`

On Windows platforms, right click on the archive file and select **WinZip** → **Extract to here**. On Linux platforms, type **unzip hic.zip** at the command prompt. A folder named *abq_hic* and a file named *hic_plugin.py* will be extracted. Note that the plug-in will not function properly if this procedure is not followed.

Usage

The HIC (Head Injury Criteria) is used to evaluate head injury severity in crash test dummies.

According to FMVSS 208 (Federal Motor Vehicle Safety Standard), the resultant acceleration at the center of gravity of the head of a 50th percentile male dummy must be such that the value of the HIC does not exceed 1000 for a 36ms time interval and 700 for a 15ms time interval. The HIC is defined as:

where:

- a* is the resultant acceleration in g's (the acceleration of gravity)
- t*₁, *t*₂ represent any two points in time during the crash separated with a maximum interval of 36ms. Units need to be in seconds.

To be able to calculate the HIC, you need to request history output of the relative acceleration components (CA1, CA2, CA3) of the dummy head accelerometer. Before you run the plug-in, save the CA1, CA2, and CA3 XY Data histories in the current session of Abaqus/Viewer. The plug-in lists the XY-Data available in the current session only and will not include XY-Data present in the odb. The plug-in provides the option to either specify the individual components of acceleration or the resultant acceleration. Note that the acceleration history must be in g's.

To invoke the plug-in select **Plug-ins** → **Crashworthiness** → **Compute Head Injury Criteria....** The following dialog will appear:

If you choose to specify resultant acceleration, select the **Raw resultant acceleration** radio button and select the appropriate XY-data from the **Resultant acceleration** combo box.

If you choose to specify the individual components of the acceleration, select the **Raw components of acceleration** radio button and select the XY-data corresponding to the 1, 2 and 3 components of the acceleration.

Choose the **Time scale factor** as seconds or milliseconds depending on the units you have used in your analysis. Also choose the **Length Unit** to which you want the results to be converted. Choose **No conversion** if you do not want any conversion,. **The selected time scale factor must be consistent with the XY-data units.** Select the **HIC window** size as **15** or **36**.

You can filter the data with one of the available SAE filters or you can use the raw data to calculate the HIC. To apply SAE filtering, toggle on **Apply SAE filter to input data** and select the required filter from the **SAE filter class** combo box. By default, filtering is applied with the SAE 1000 filter.

Click **Compute**, and the HIC value will be displayed in the title of the XY-plot of the acceleration data being used. The HIC resultant and HIC window histories will be saved in the **XY Data Manager**.

Revision History

29 May 07	Version 1.1-1 of plug-in released.
17 Nov 08	Version 1.1-2 released to add support for length unit.
16 Apr 11	Release 1.3-2. Support for 6.10 and up.

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The attachments to this article are subject to certain usage conditions. Please [click here](#) for details.

KEYWORDS hic, HIC, crash, airbag, autocrash, impact, 3112

ATTACHMENT	hic.zip	Answer_3112_hic-1.png	Answer_3112_hic-2.png	answer_3112_hic-1.png
	answer_3112_figure1.gif	answer_3112_hic-2.png	Answer_3112_Figure1.gif	

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