A Unified Environment For Processing Test Videos And Simulation Models

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1 Introduction

Videos have increasingly become an integral part in the process of engineering design, especially for validation and proof of design. META, a powerful software for post-processing finite element simulation results also facilitates importing videos. Using META engineers have all the necessary tools for the visualization, comparison and processing test videos and simulation models.

2 Scope of the presentation

2.1 Introduction

An overview of the cases to be presented in this paper, using a LS-DYNA simulation model and two videos from different angles of a test:

1. Matching of the model view with that of the test video.
2. Synchronization of the model's States with the frames of the test video.
3. Plotting of curves from the model and from tracked points and measurements on the video.
4. Creation of video grid and local frames - eliminating rigid body motion from video frames.

2.2 Matching a model with video views

In META videos are imported in the same work-window that the simulation model exists. The view of the model can be matched to that of the video with a minimum of 7 matching points (or 3 points for coplanar videos with 2D view required), marked in green. Threse are defined by the user interactively, by picking points on the simulation model and the corresponding on the test video's bitmap:
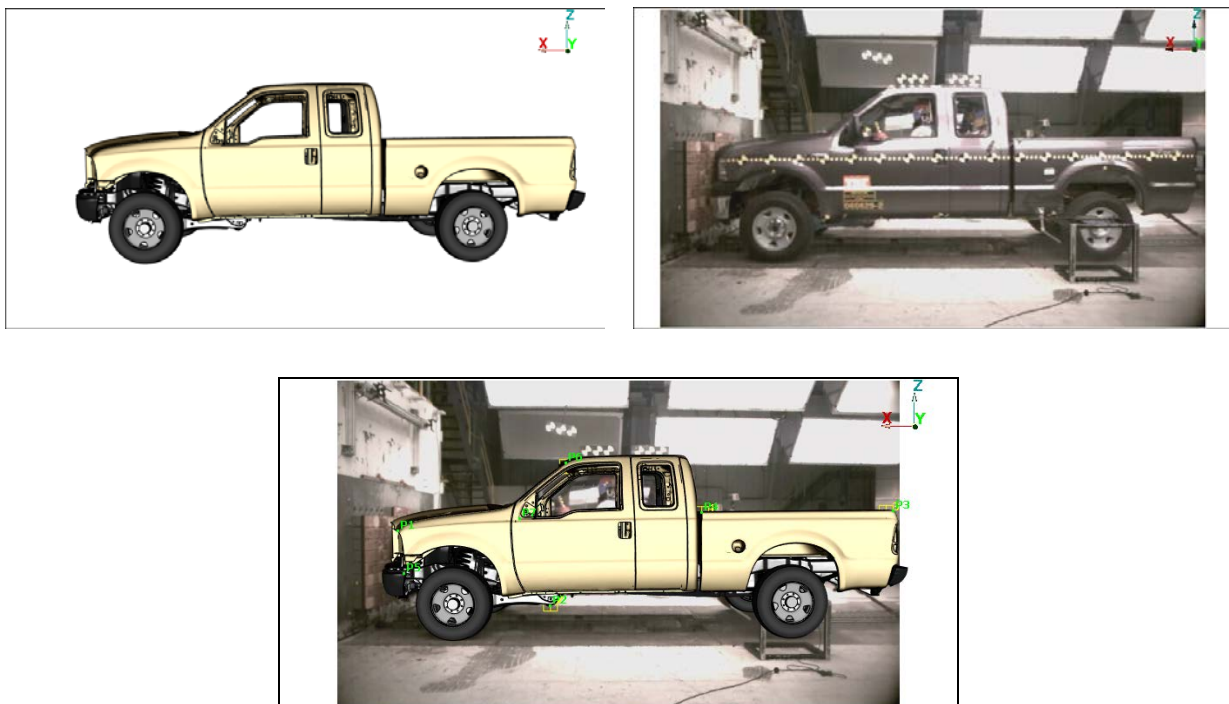

Fig.1: Simulation model matched to test video

2.3   Synchronization of simulation States and video frames

The number of states of the simulation model has to be synchronized with the corresponding video frames. The user selects the range of states and frames and META linearly interpolates the animation steps to synchronize the model movement with the video frames:

Fig.2:   Model states synchronized with video frames

2.4   Plotting curves of measurements

Results of interest can be plotted both from the simulation model and the video. In the following example the acceleration curve of a node from the simulation model and the acceleration of a point picked from the test video are plotted, calculated from the corresponding displacements:
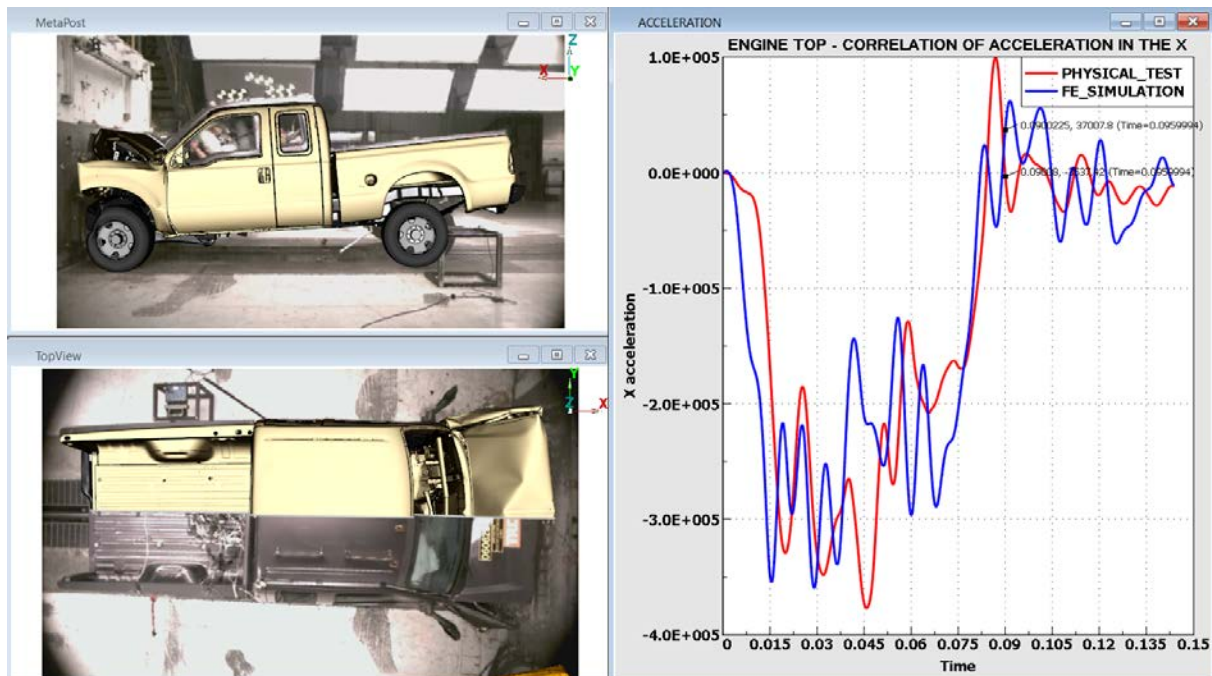

Fig.3:   Curves plotted from simulation model and test video

Note that multiple work-windows co-exist in META for 3D models, videos and 2D graphs. Additional videos, in this case from the top view point of the test, can be imported for comparison with the corresponding view of the simulation model. A cutting plane was created to aid the visual comparison. It is also possible to plot distances and angles between selected points.

For cases that the display of tracked point is lost behind a feature, while the video is replayed, it is possible to fix manually the point trajectory tracked by META. There is a tool dedicated to performing this action by the user frame-by-frame, with a detailed view of the area of interest:
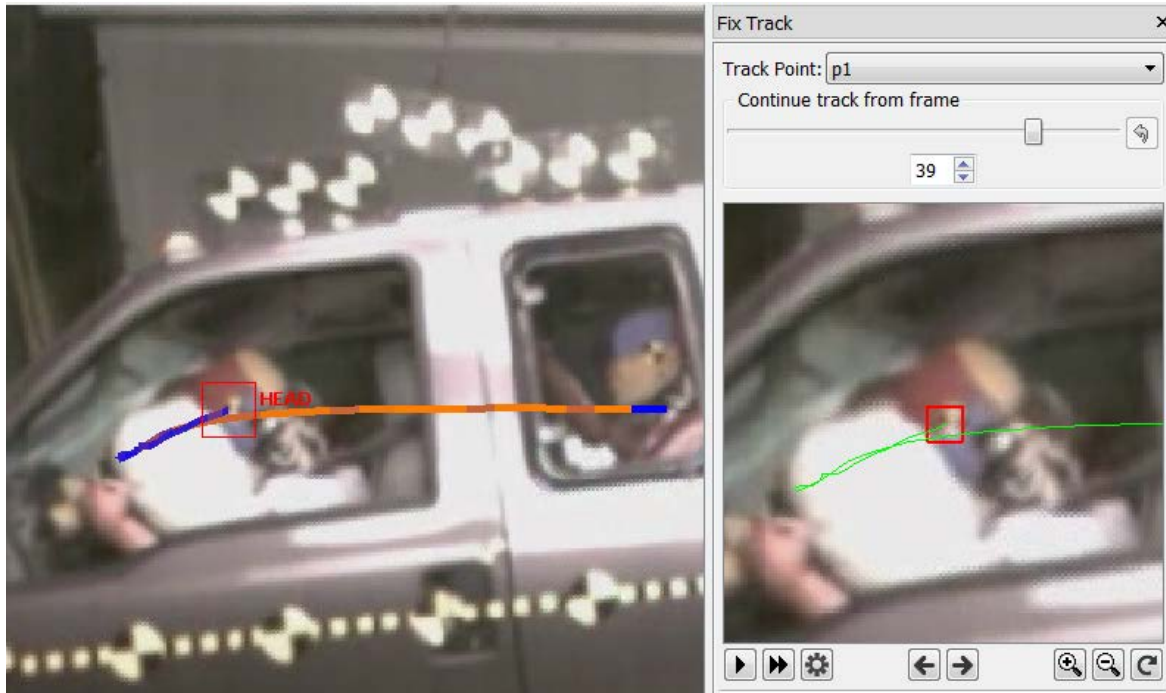

Fig.4:   Manual fix of tracking point trajectory

With each corrected frame, the rest of the trajectory is automatically recalculated by META and the user has the option to continue fixing frames or let META conclude the action.

2.5   Test video results on local frame

Another case of tracking points of interest on test videos is to transform tracked results on a local coordinate system/frame, static or dynamic. In this case the motion will be transformed on an axis based on two points of the video's moving object:

Fig.5:   Creation of local dynamic frame

Playing back the video, the moving object is in-line with the axis of the two selected points, while the video is rotated accordingly:
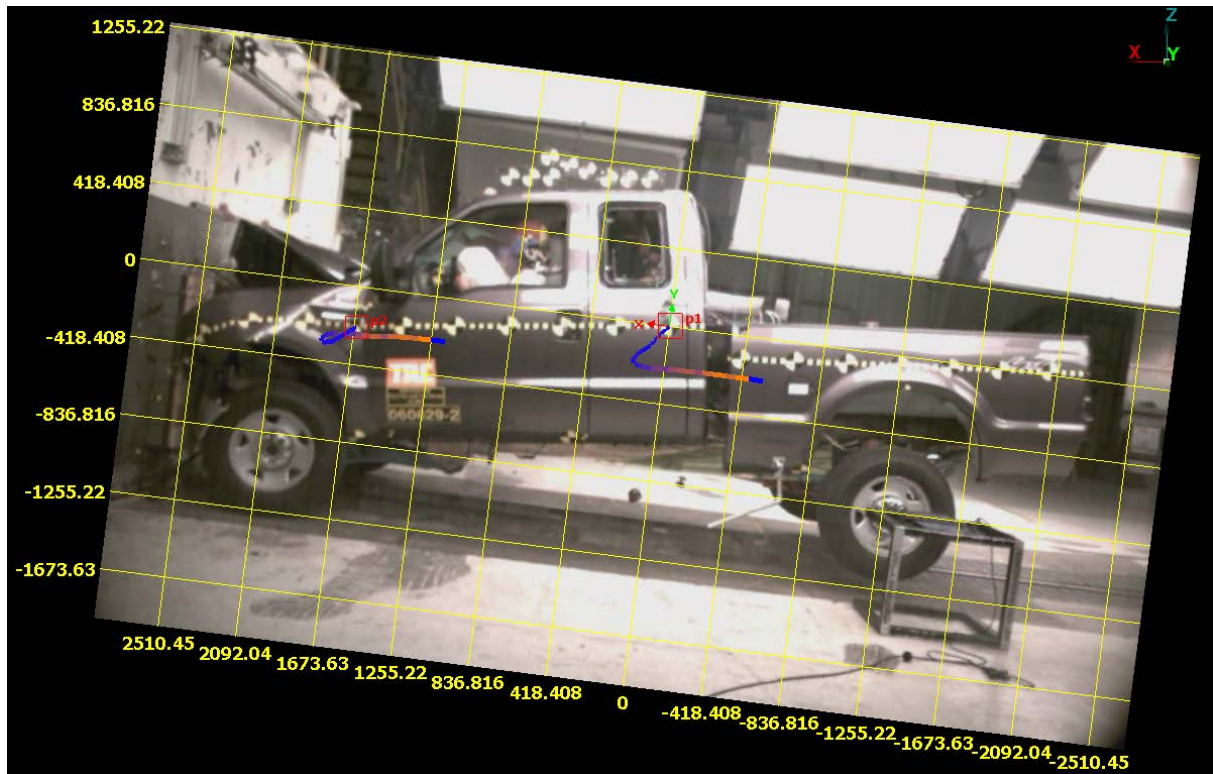

Fig.6: Playing back of video in relation to dynamic coordinate system

3 Summary

META has a comprehensive set of tools for processing test videos. Coupled with the powerful but effortless handling of multiple models and curves over multiple work-windows, META proves itself to be a valuable and reliable tool for the engineer that requires a robust solution for comparing videos with simulations.

4 Literature

[1] META v16.1.1 Users' Guide, BETA CAE Systems, 2016