

Momentum – 360 Digital Momentum

Overview: Computes the Impact Speeds, Angles and DeltaVs for angular and inline collisions using a Drag and Drop interface with digital inputs available on an interactive graphical interface. This module interface effectively marries output from the CrushV module and the Motion Analysis module using a graphics display to consolidate information on position and damage analysis verifying the linear momentum solution. It then takes the finalized data and transfers it to the 360 Linear Momentum module for further technical and statistical analysis.

Entry into Module:

This module of the program is entered by clicking on the **REC-TEC** block in the upper left of the **REC-TEC Window** causing the drop-down menu to appear. Place the cursor on the **Momentum** block and click on **360 Digital Momentum** on the sub-menu to initiate this module.

Data Entry:

Approach Data:

- **Angles (1 and 2)** – Approach Angles are automatically computed when the “flags” for the vehicles (**V1** and **V2**) are moved by grabbing and dragging them with the mouse or by manually entering the values for the **X** and **Y** positions of the vehicle **CG**.
- **Weights (1 and 2)** – Weight, length and width of each vehicle is automatically entered if the user employs AutoStats or AutoStats Lite and selects a particular vehicle for transfer to Digital Momentum.

Collision Data:

- **CG Location at Collision** – These points are automatically computed when the “flags” for the vehicles (**C1** and **C2**) are moved by grabbing and dragging them with the mouse or by manually entering the values for the **X** and **Y** positions of the vehicle **CG**.

Departure Data:

- **Angles (3 and 4)** – Departure Angles are automatically computed when the “flags” for the vehicles (**V3** and **V4**) are moved by grabbing and dragging them with the mouse or by manually entering the values for the **X** and **Y** positions of the vehicle **CG**.
- **Speeds (3 and 4)** – are automatically computed when the “flags” for the vehicles (**V3** and **V4**) are moved by grabbing and dragging them with the mouse or by

manually entering the values for the **X** and **Y** positions of the vehicle **CG**. These post-impact speeds are determined by the length of the departing vector.

Output:

The frames at the top of the screen show the **Output – Unit (1 or 2)** information as follows:

- **Vn Impact:** Impact Speeds of both vehicles in the units used for entry
- **DeltaVn:** Change of Velocity (**DeltaV**) of both vehicles in the units used for entry

Graphics:

The basic graphics display shows the pre-impact vector (angle and speed), the **CG** location at collision and the post-impact vector for each of the vehicles. The **X** and **Y** coordinate positions are given for each of the points described as well as the weights, speeds and angles associated with the event. The PDOF/Impulse vectors are also shown for the collision. Impact speed and DeltaV is shown for each vehicle at the top of the screen.

The center-top buttons (**V1 & V2 .SPN file**) will permit **Motion Analysis** files to be imported as post-impact trajectory data for each vehicle including the trajectory over the ground, which is drawn to scale. The **AutoStats** and **AutoStats Lite** Buttons allow importing of critical vehicle dimensional data (including weights) that is used to draw scale outlines of the vehicles.

The upper-right buttons (**V1 & V2 .CRS file**) will permit **CrushV** files to be imported with scale dimensional data as well as **CrushV** profiles of the damage (including **C** measurements and **Zones**) for graphical display and analytical analysis. The centroids of damage of the vehicles are displayed as well as PDOF, lever arm, Impulse vectors, and computed rotational information. The program then re-computes the PDOF and Impulse information based on the momentum data for the collision configuration and displaying these vectors in addition to that imported from **CrushV** allowing verification of the **CrushV** PDOF input data.

As the graphics are drawn on the screen, the module outputs two different (.asc) output files. **DLMs2CAD.asc** creates a textfile of the collision scaling the vectors to speeds. **DLMd2CAD.asc** scales the diagram to distance in feet.

Options:

Several **Command Buttons** appear along the top of the frame. The **Command Buttons** allow the user to manipulate the screen (up, down, right and left) as well as turn on or off the grid and the data blocks for the vehicles. Buttons are also available for transferring vehicle data from **AutoStats** or **AutoStats Lite** and for the **Transfer** of the screen linear

momentum information to the **360 Linear Momentum** module for additional processing including **Vector Sum** and **Finite Difference** analysis.

- **Open .DLM File** – Calls up a **Dialog box**, which **Opens** any pre-existing **.DLM** file and displays the output results.
- **Save .DLM File** – Calls up a **Dialog box**, which **Saves** data on the screen to files with any user-selectable filenames. This is independent of the automatic saving as “**LastFile.DLM**” of the data at the close of this module or the close of the program.
- **Slider Bar (bottom of Display)** – Zooms the Display in or out to facilitate locating the Centroids at maximum engagement in the collision.
- **<, >, ^, v** – Moves the display in the direction of the arrowhead. Buttons change color to indicate the direction to move to return to center.
- **Grid** – Displays or hides the grid. When hidden, the Axes are still shown and delimited.
- **Center** – Centers the display, which may not automatically refresh. The **Grid** button may be used to refresh the screen without re-centering. Right clicking on the screen will also refresh the screen. This is changed to centering the Centroids on the screen if the Centroid checkbox was used to auto-align the Centroids of damage.
- **Centroid** – Checking this radio button will automatically realign the entire trajectory of **Vehicle 2** aligning the Centroid of Damage with the Centroid of Damage of **Vehicle 1**. The re-alignment does not change the speed or deltaV of either vehicle; it realigns the trajectory of **Vehicle 2**.
- **Hide/View Data** – Removes or Displays the data blocks to the individual inputs.
- **Transfer** – Transfers data and control to the **360 Linear Momentum** module of the program for additional processing. Data is transferred as selected in the display units selection at the lower left of the screen.
- **AutoStats** – If **AutoStats** is located on the computer (see **Setup > REC-TEC**) this button will be Active and call up the **AutoStats** Vehicle Exchange Files. The data from these files including the weight is transferred to a vehicle by clicking on either the **V1** or **V2** button.
- **AS Lite** – Calls up **AutoStats Lite**. The data from a selected vehicle files including the weight is transferred to a vehicle by clicking on either the **V1** or **V2** button.

- **Vn - .SPN file** – Loads departure data directly from a **Motion Analysis** file and displays this information on the screen. Initial velocities (in feet per second) are shown in the label boxes at the lower center of the screen. To remove these files, click on the Command button and then bring up the dialog box. Select cancel and the file and data are removed.
- **Vn.CRS file** – Loads (scale) vehicles from **CrushV** for positioning on **Motion Analysis** reference points in the post-impact trajectories. If no scale vehicles are loaded, the user can use rectangles or arrowheads to show positions. To remove these files, click on the Command button and then bring up the dialog box. Select cancel and the file and data are removed.
- **Coordinate Mode** – Allows direct numerical entry and manipulation of the X and Y Coordinates for Approach, Collision and Departure. This mode can not be used in conjunction with the Departure data files imported from **Motion Analysis**. Since the **Motion Analysis** files represent hard data measured at the scene regarding distances, it would be improper to manipulate this data. The Departure Speeds and Departure Angles are variable (numerical inputs - **Analytical Mode**) depending on the friction and braking and departure angles of the vehicles. The user is also allowed to vary the Approach Angles (numerical inputs - **Analytical Mode**) accommodating the last minute evasive action by one or both drivers. As these changes are entered, the locations of the new Approach and Departure vehicles are displayed as vectors scaled to the Approach and Departure Speeds and Angles. The original locations are displayed as located by coordinate positions (not scaled to the speeds) and the heading angles of the original Approach and Departure vehicles match the new Approach and Departure vectors.
- **Cars / Arrows** – Switches between using rectangles (scale width and length if **AutoStats** or **AutoStats Lite** vehicles are used) and arrows in order to display the Motion Analysis points. If a **.CRS** file (**CrushV**) vehicle is selected, this will be used regardless of the selection. If both vehicles use **.CRS** files, the selection is not available.