

Momentum – 360 Linear Momentum

Overview: Computes the Impact Speeds, DeltaVs, PDOFs, Energy and Momentum data for angular and inline collisions.

Entry into Module:

This module of the program is normally 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 Linear Momentum** on the sub-menu to initiate this module.

Under certain circumstances, the user may choose to use the **Files** block instead of the drop-down menu approach. Selecting any file with an **.LMO** extension in the **Dialog box** accessed from either the **Open Single File** or **Open Multiple Files** block opens this module.

Selecting **AutoLoad [ON]** from either the **Setup Menu** or the **AutoLoad Icon** on the upper right side (third line) of the **REC-TEC Window** automatically loads the scenario that was on the screen when the module was closed, either individually, or when the program was closed. With **AutoLoad [OFF]** on the main **REC-TEC Window**, modules will start without loading a file.

Data Entry:

Number of Fragments (1 - 4)

- Program accommodates up to four exit fragments for each Entry Unit

Checkbox for Rear End Collision – Check if Rear End Collision

- Checking this box calls up a frame for entering EBSpeeds for both units if desired. The Equivalent Barrier Speeds enter into the computations for the impact speeds.

V2 Speed (Known) – Enter Value in Textbox

- Negates the computation of **V2** and proceeds to compute **V1** based on the value entered.

This module contains the following data entry blocks for each of the two Units within the leftmost set of frames:

Approach Data:

- **Angle (1 or 2)** – Approach Angle (Enter appropriate angle for Left or Right Hand

Coordinate System / Heading or Radial configuration)

Departure Data:

- **Motion Analysis** files may be used for **Departure** information (single fragment only). These files will supply **Departure Speeds** and **Trajectory** data for Animation.

Odd / Even Fragments:

- **Angle (N)** – Approach Angle (Enter appropriate angle for Left or Right Hand Coordinate System / Heading or Radial configuration)
- **Weight** – Entered as actual weight or ratio
- **Speed** – Enter Post-Impact speed or enter zero (0) to display frame for entering the following data:

Or

- **Mu**
- **Grade (Test)**
- **Grade (Scene)**
- **% Braking (100)**
- **Distance**

Output:

The two frames on the right side of the screen show the **Output – Unit (1 or 2)** information as follows:

- **PDOF(A-Number)** – Direction of Impulse Vector relative to heading of Vehicle
- **Impulse:** Change of Momentum
- **DeltaV-Lat:** Lateral Change of Velocity (Primary)
- **DeltaV-Lat:** Lateral Change of Velocity (Secondary)
- **DeltaV-Lng:** Longitudinal Change of Velocity (Primary)
- **DeltaV-Lng:** Longitudinal Change of Velocity (Secondary)
- **DeltaV:** Change of Velocity (Primary)
- **DeltaV:** Change of Velocity (Secondary)

Post Impact

- **Speed:** Impact Speed (Primary) – Input or Computed
- **Speed:** Impact Speed (Secondary) – Input or Computed

Intercept (Pre-Impact) and Separation (Post-Impact)

- **Angle:** Intercept (Closure) / Separation
- **Momentum:** Pre-Impact / Post-Impact
- **Energy:** Kinetic at Impact / Kinetic after Impact
- **Energy:** Actual / Maximum for Damage including Rotation
- **Speed:** Speed (Primary) – Closure / Separation
- **Speed:** Speed (Secondary) – Closure / Separation

Impact

- **Speed:** Impact Speed (Primary)
- **Speed:** Impact Speed (Secondary)

- **eVelocity:** Coefficient of Restored System Velocity (**Restitution**)
- **rVelocity:** Coefficient of Retained System Velocity (**Vs/Vc**)

Options:

Several **Command Buttons** appear in a frame located at the lower right corner of the module Window. The **Command Buttons** allow the user to engage options including the option to **Open** and **Save** the data required to generate the scenario shown on the screen at the time the file was saved.

- **Open .CSV File** – Calls up a **Dialog box**, which can **Open** a pre-existing **CadZone (.CSV)** Linear Momentum file and displays the output results.
- **Open .LMO File** – Calls up a **Dialog box**, which **Opens** any pre-existing **.LMO** file and displays the output results.
- **Save .LMO 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.LMO**” of the data at the close of this module or the close of the program.
- **Formulae** – Opens a word processor (set by the user in **Setup**) with a file showing the basic formulae used in this module of the program. While the user may add to or modify the information in this file, it does not change the formulae imbedded into the program.
- **Formulae*** - Toggles a frame displaying the formulae for computing the unknowns in this module. In addition to the basic formulae, the frame shows intermediate steps with the actual input data shown in the computation.

- **Graphics** – Displays the Linear Momentum graphics along with LM data on the sight side of the screen. Clicking on the right mouse button brings the graphics for calculating the Line of Impact and Restitution. [Esc] to Exit
- **Vector Analysis** – Displays the Linear Momentum Vector Sum Analysis diagram along with LM data on the sight side of the screen. Line of Impact is toggled by clicking the right mouse button. [Esc] to Exit
- **Velocity Vector Analysis** – Displays the Velocity Vector Analysis diagram along with LM data on the sight side of the screen. Line of Impact is toggled by clicking the right mouse button. [Esc] to Exit
- **Animation** –The display shows the two Units in 360-degree format. This module permits loading scale vehicles (.CRS – Crush) in animation – negates tilting of Z-Axis. Vectors scaled to Velocity/Distance, Velocity or Momentum. User selectable views include the ability to Tilt or Rotate the X, Y and Z-Axis of the animation. Maximum Engagement point can be matched to collision. Animation may be stopped and then resumed using the mouse or the spacebar. [Esc] to Exit
- **Energy Momentum** – Uses an Energy-Momentum Quadratic to calculate the correct angular relationship between the Approaching Units and showing the computed angle for Unit 2. The screen shows the new Impact speeds based on the changed angle and allows transfer of the information back to the Linear Momentum main entry screen correcting Approach Angle 2.
- **N** – This button toggles a graphical number pad on the screen that can be used to enter data into the input boxes without using your keyboard number pad. This may be useful for presentations as data entry can be accomplished using a wired/wireless mouse.
- **Iteration / FDA Menu** – Calls up a frame that permits the user to input the minimum and maximum values for selected input variables along with the interval for **Iteration**. If **Finite Difference Analysis (FDA)** is selected, the resulting analysis computes the uncertainty level for the specified range of the input variables.

For a more in-depth description of **Finite Difference Analysis**, see the Finite Difference Analysis Section of this Manual – Press [F2] from any Active module of the program.