

BONDS ANALYZER

This module is used to analyze states of active solid bonds and export results as file in text format (comma-separated values, .csv). Data for the analysis is taken from the results file (*.mdem), therefore saving step which was used during the simulation can influence the accuracy of the results. Linear interpolation is used to obtain data between saved time points.

User can obtain information about the following parameters of solid bonds (*Fig. 1 - Property*):

- *Bond Force (+/-)*: magnitude of summarized (normal + shear) force acting in bond, positive value – compression, negative – tension;
- *Diameter*: distribution of solid bonds according to their diameters;
- *Force Total*: vector of force acting in solid bonds (in normal and shear direction);
- *Length*: current length of solid bond;
- *Number*: total number of active solid bonds;
- *Velocity Total*: velocity of bond is approximated based on velocity of contact partners.
- *Deformation*: this value represents the absolute deformation of bonds compare to its initial length. It is calculated as $InitialLength - CurrentLength$, therefore the positive values correspond to the compression, negative – to the tension.
- *Strain [%]*: calculated as $(InitialLength - CurrentLength) * 100 / InitialLength$. Positive values correspond to the compression, negative – to the tension

Four following results types can be selected (*Fig. 1 – Results type*):

- *Distribution*: distribution of selected parameter by specified number of classes on specific time interval (list of time points, see below). In this case the results will be generated as a table where each row represents a time point and each column corresponds to the specified property interval. Each cell of the table contains number of solid bonds which have property value within the given interval;
- *Average*: the result is an arithmetic average value of selected property for each time point. Additionally the information about number of considered solid bonds and deviation for each time point will be provided in results;
- *Maximum*: maximum value of selected property for each time point;
- *Minimum*: minimum value of selected property for each time point.

For such properties as *Total Force* and *Total Velocity* besides the magnitude (*Length*) a specific component of resulting vector (*X, Y, Z*) can be determined (*Fig. 1 – Vector component*).

Each property can be obtained for specific time interval, divided into classes (*Fig. 1 - Time*). Values will be exported for each time point from interval $[T_{FROM}; T_{TO}]$ starting from T_{FROM} with specified time step ΔT .

For example for initial data $T_{FROM} = 0$ s, $T_{TO} = 5$ s, $\Delta T = 1$ s, the results will be generated for time points 0, 1, 2, 3, 4, 5 s. To get values for only one specific time point T specify $T_{FROM} = T_{TO} = T$. There is also a possibility to obtain results only for those time points, which were saved during the simulation (thereby avoiding the interpolated results).

To analyze distribution of some property (*Results type: Distribution* is chosen), there is a possibility to specify range of values for selected property and number of classes on which this interval will be divided (*Fig. 1*). Bonds whose properties do not fall within a predetermined range **will not be considered**. The result for each class at a specific time point is a number of bonds whose properties fall within this class. If the value is exactly on the boundary between intervals, it will be assigned to a greater interval.

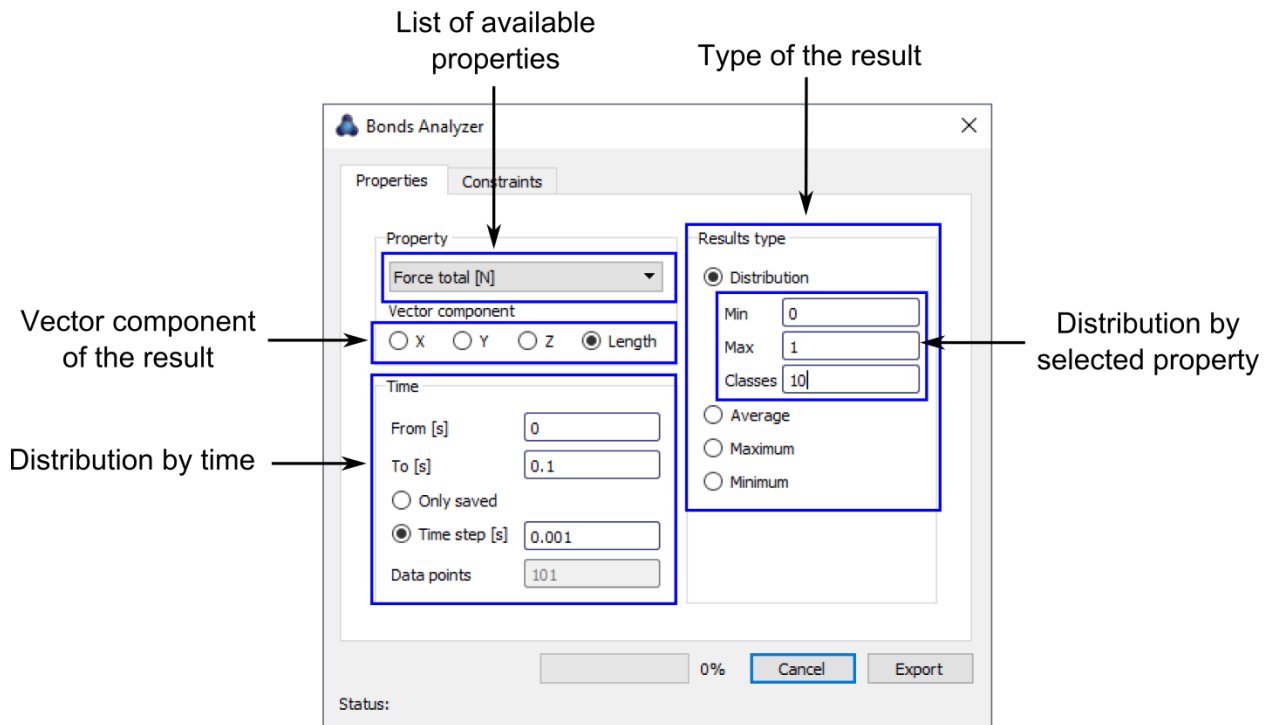


Figure 1. Main dialog of the Bonds Analyzer.

You can additionally specify one or several constraints, which will be applied for solid bonds. **Turning on filters can slightly reduce performance of the analysis.** Following constraints are available:

- *Materials*: only solid bonds of selected materials will be taken into account during the analysis;
- *Diameters*: only solid bonds with diameters within specified interval will be considered;
- *Volumes*: only bonds which are situated in specific volume will be considered. Center of bond is used for analysis.