

GEOMETRIES EDITOR

The geometries editor allows to add, modify or to define time-dependent velocities of geometrical objects. Two types of geometries are available in MUSEN: *real geometries* (normal walls, apparatuses part etc., which are considered in contact detection algorithm), *analysis volumes* (imaginary volumes which are used for data analysis only). The geometry can be imported from external CAD programs (STL volumes) or created based on standard MUSEN geometries (Sphere, Box, Cylinder, Hollow sphere).

In the geometries editor following parameters can be specified:

- *Name*: by double-click on the geometry the new name can be specified;
- *Add*: add a real geometry or analysis volume to the scene;
- *Delete*: remove selected geometry from the scene;
- *Color*: choose a desired color of the selected geometry;
- *Material*: material of *real geometries* can be modified (taken from the materials editor);
- *Center*: center of geometrical objects. In the case of STL geometry – this point is defined as a center of bounding box. In Fig. 1 determination of center is schematically shown;
- *Rotation*: rotate object around X, Y and Z axis. Rotation can be applied only for STL volumes;
- *Shift upwards & Shift downwards*: geometrical object will be automatically shifted upwards or downwards until first contact with particle. Can be effectively used in compression tests to place compression walls (youtu.be/um8A3S9W4ek);
- *Geometrical parameters*: specify the spatial parameters like length, breadth, height, radius etc. of the chosen geometry;
- *Number of Triangles*: choose the degree of geometry accuracy for the simulation. The more the number of triangles, the greater is the degree of accuracy, however, the more is time is consumed during the simulation. There are a minimum and a maximum for each geometry;
- *Mass & Free motion direction*: combination of this feature with definition of time-dependent velocity can be effectively used for many investigations. It allows to define total mass of geometrical object and free motion direction. In the each calculation time-step total force acting on geometry will be calculated and according to this force object will automatically move in free motion direction. For example, in order to simulate shear test: define axial velocity of object, set its mass and define Z-direction as free motion direction;
- *Time-dependent velocity*: translational and rotational velocity of object for several time points can be defined (youtu.be/woCKp1ohOEM). There is no interpolation between time points. For example: if two time points 2, 4 seconds and accordingly velocities 0.1, 0.9 m/s are defined. Then on time interval [0;2) object will have no velocity, on interval [2;4) will have velocity 0.1 and on [4,..] will have velocity 0.9 m/s. For specification of rotational velocity, rotational point (center of rotation) and angular velocities should be defined.

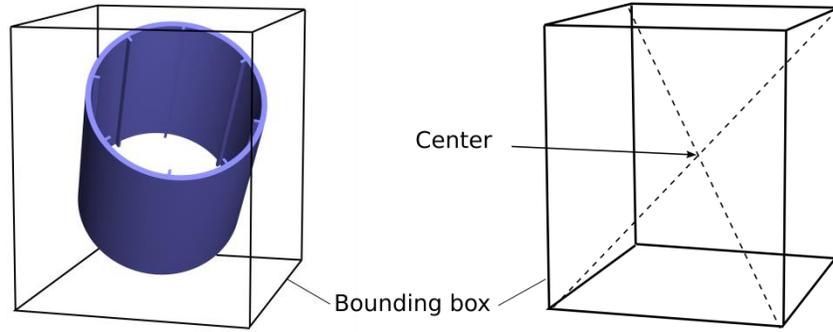


Fig. 2. Calculation of object center.