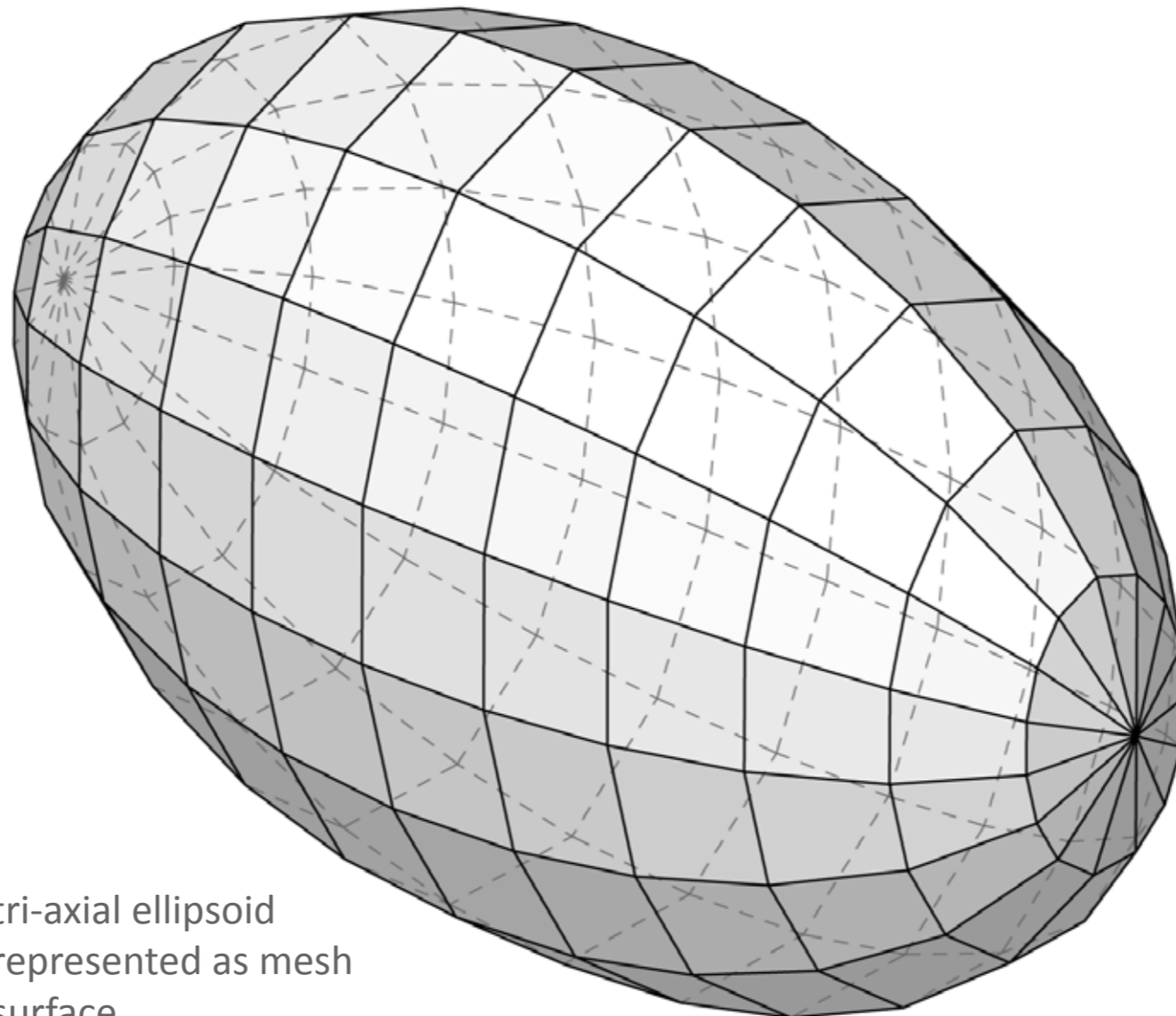


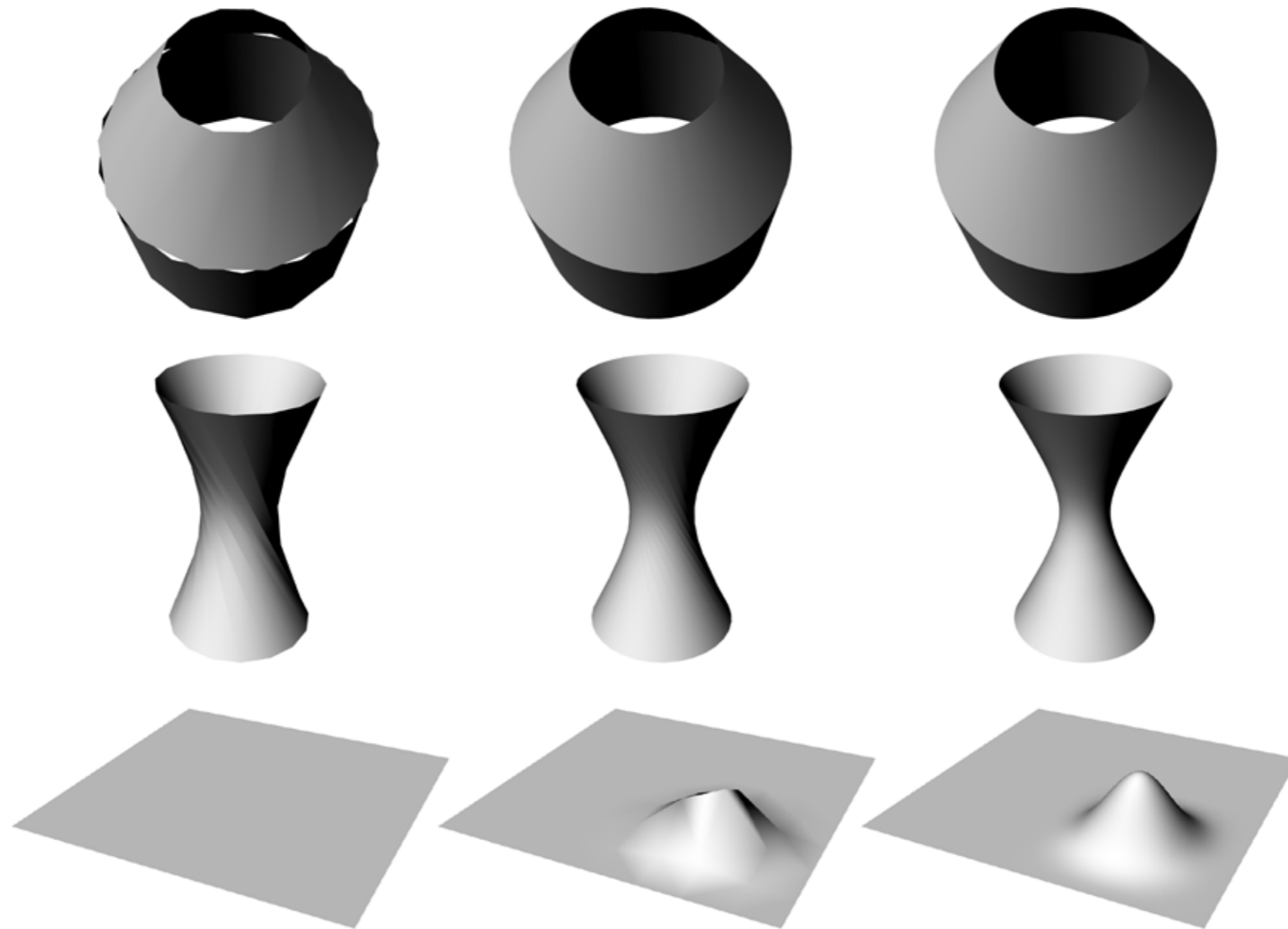
- representation of surfaces by triangular or quadrangular small surfaces, given by mesh of vertices and edges
- not exact, more accurate with more vertices
- the best results are with changing size respectively to curvature



tri-axial ellipsoid
represented as mesh
surface

- modern programs don't define surfaces by meshes
- anyway they usually support meshes, including some tools for creating and editing
- they are used as an exchange format
- they are used for difficult tasks like rendering – render mesh

- used as well as for rendering as for shading while editing
- is not usually directly seen by user
- usually using Geraud nebo Phong shading



→ creating commands:

- RULESURF (ruled surface)
- REVSURF (surface of revolution)
- TABSURF (extruded surface)
- EDGESURF (from edges)
- 3DMESH (field of points)
- 3DFACE (one mesh surface)
- 3D (primitives)

→ editing gives little possibilities, only:

- moving vertices one by one
- EXPLODE (*mesh* to *3Dface*)
- no possibility to change *mesh* to *surface* or *solid*

→ created objects:

- *mesh*
- *3D Face* (one mesh surface)

→ system variables:

- SURFTAB1 gives number of surfaces in u direction
- SURFTAB2 gives number of surfaces in v direction

→ render mesh smoothness variables:

- VIEWRES (for editing mode)
- FACETRES (for rendering)
- for rendering the smoothness is a multiplication of these two

- allows to edit faces face by face if one face is selected (using CTRL):
 - moving – MOVE
 - rotating – ROTATE & 3DROTATE **extruding** – MESH EXTRUDE
 - collapsing face or edge – MESH COLLAPSE
 - splitting faces of mesh – MESH SPLIT
 - joining faces of mesh – MESH MERGE - etc.
- allows redefining number of faces MESH REFINEMENT
- allows converting of *mesh* to *solid* or *surface* using CONTOSOLID & or CONVTOSURFACE
- allows smoothing of meshes by adding subfaces:
 - number of subfaces is called *level of smoothness* and can be increased and decreased, possible to change in the properties dialogue
 - **commands:** MESHSMOOTHMORE & MESHSMOOTHLESS;
 - **variables:** SMOOTHMESHMAXFACE, SMOOTHMESHMAXLEV

→ creating commands:

- `Mesh`, `ExtractRenderMesh`
(from NURBS surfaces)
- `PlanarMesh`,
`MeshPolyline`, `MeshPatch`
(from curves),
`MeshFromPoints` **(from points)**
- `3DFace`
- `MeshBox`, `MeshSphere`,
`MeshEllipsoid` **(primitives)**

→ created objects: *mesh*

→ render mesh smoothness:

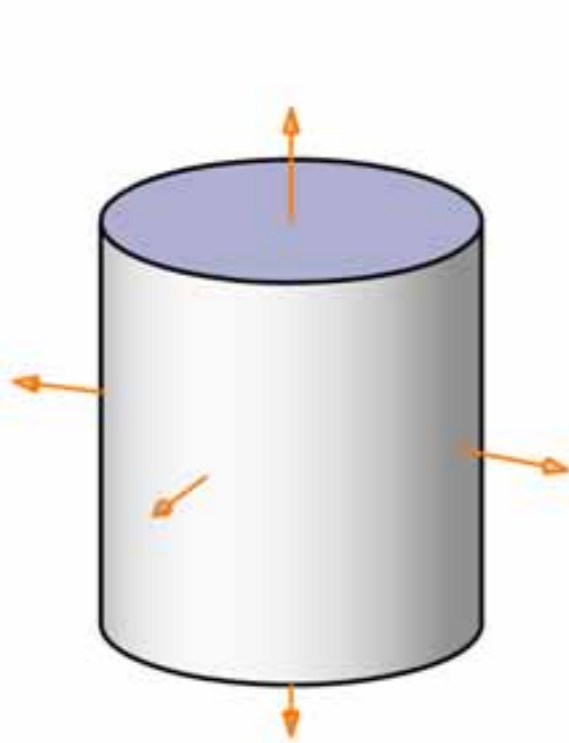
`DocumentPropertiesPage`,
option `Render`

→ editing:

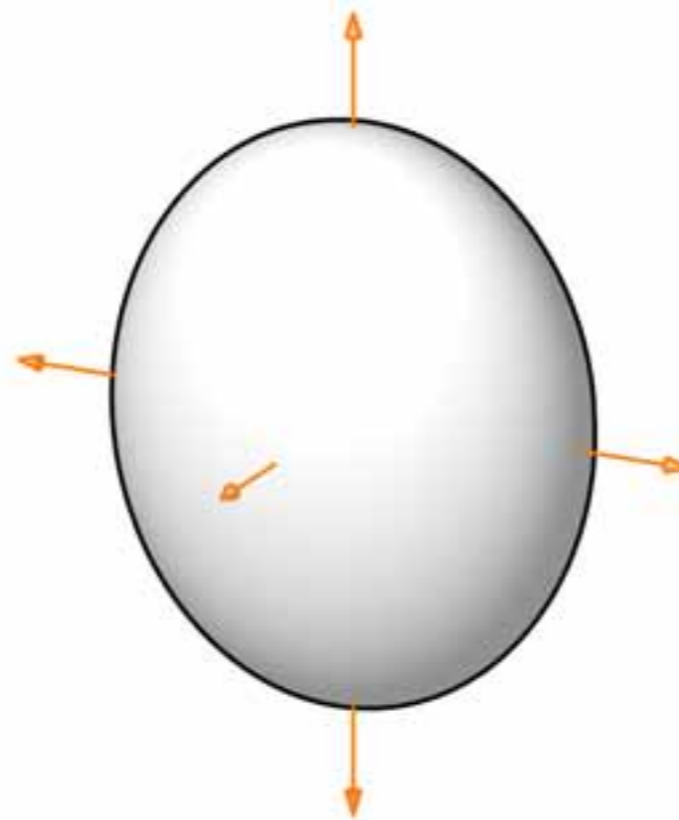
- `MeshBooleanUnion`,
`MeshBooleanSplit`
(booleanovské operace)
- `MeshTrim` **(trimming)**,
`MeshSplit` **(splitting)**
- `Weld/Unweld` **(sets/unsets Geraud shading)**
- `TriangulateMesh` **(sets all faces to triangles)**
- `ExtractMeshEdges` **(makes curves from edges)**
- `MeshToNURB` **(makes NURBS surface from mesh)**
- **and other**

- solid is a three dimensional object, volume can be measured
- real environment is solids, not curves or points
- solid is a part of 3D space surrounded completely by surfaces (or one closed surface)

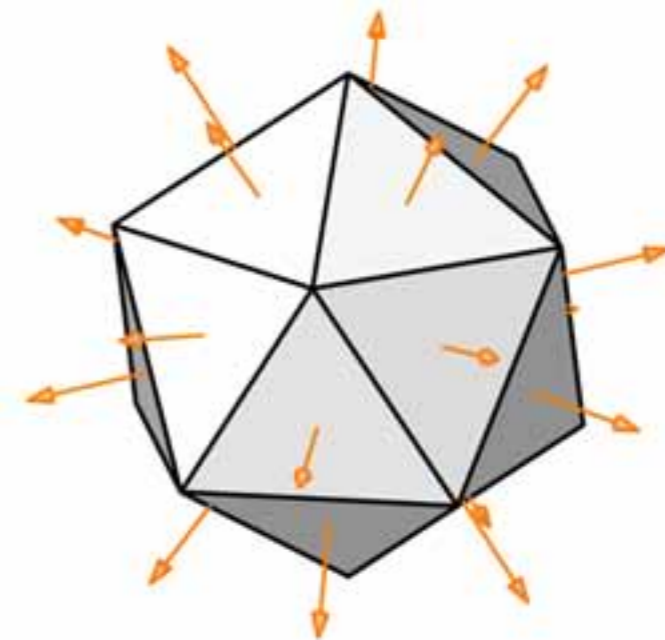
- box, cube, cylinder (extruded surfaces closed by bases surfaces)
- sphere, ellipsoid (closed surface of revolution)
- cone and cylinder of revolution (surfaces of revolution closed by bases surfaces)
- pyramid (extruded surface with changing profile closed by base)
- general ellipsoid (closed surface)
- regular and partly regular polyhedrons



straight circular cylinder



tri-axial (general) ellipsoid



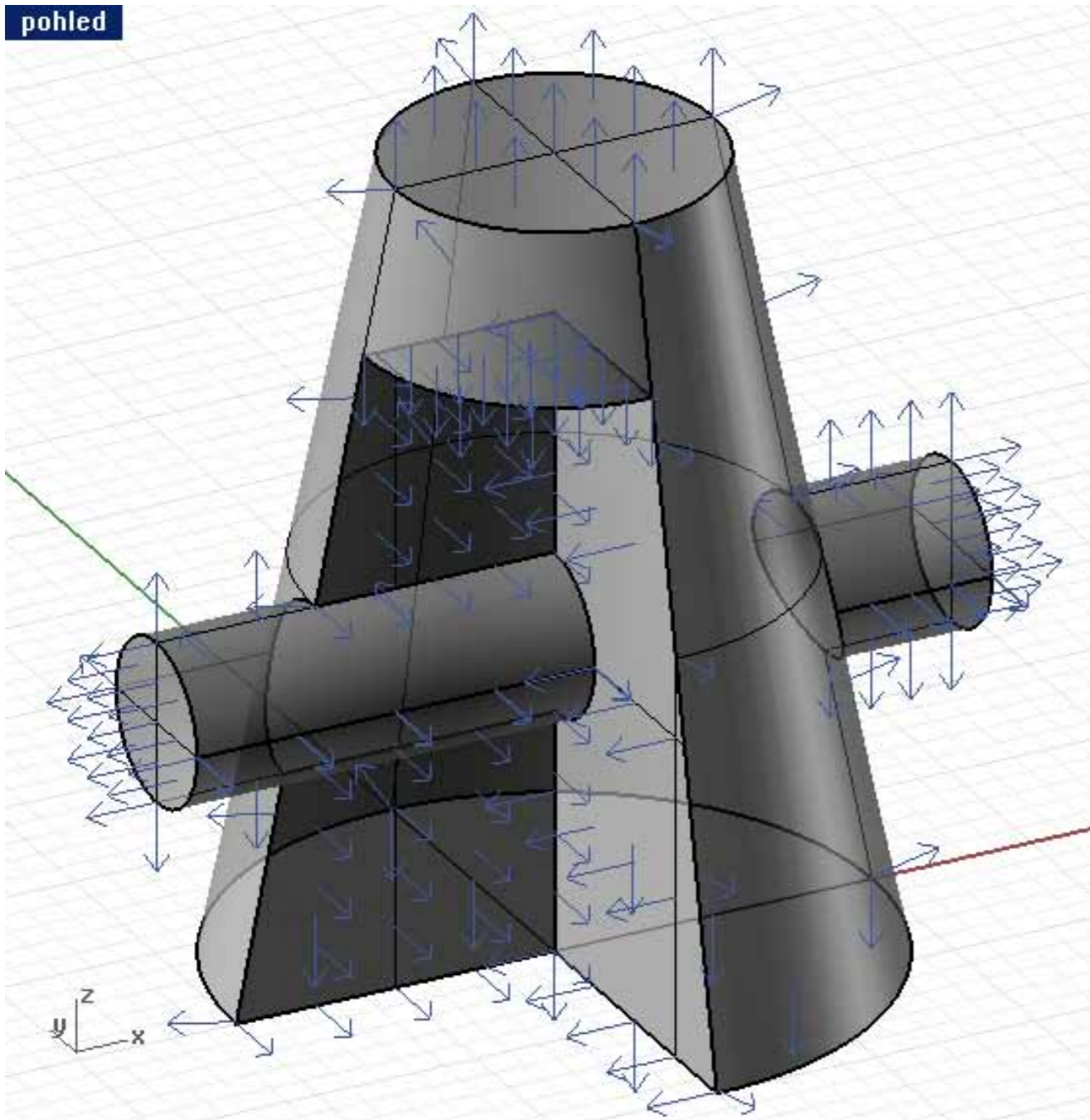
icosahedron

→ ways of modelling in CAD:

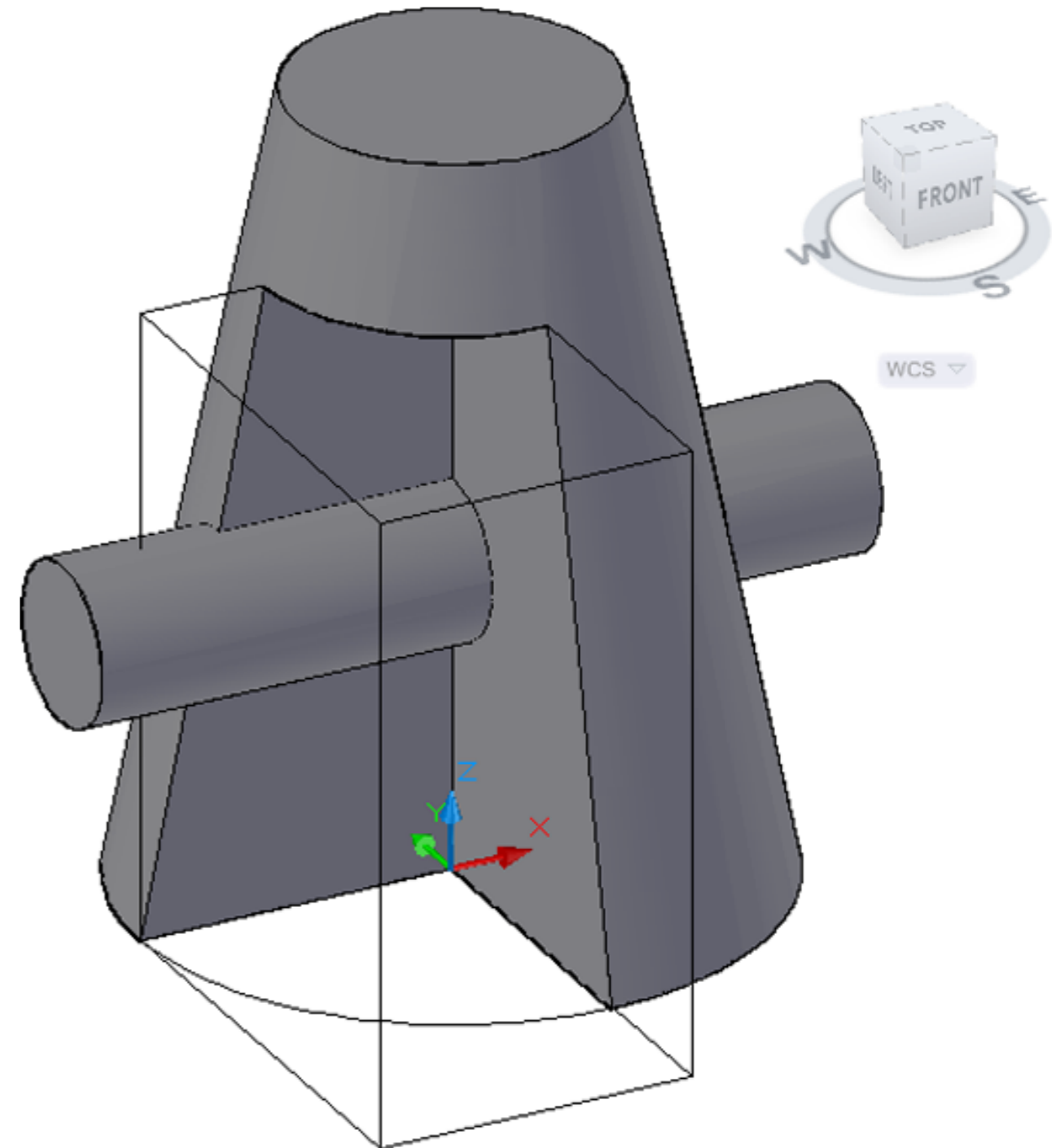
- primitives
- geometric modelling
- surface addition (in shared edges)
- Boolean operations (field operations – union, subtraction, intersection)

→ types of models of solids

- **wireframe model** – contains information about vertices and edges, is not uniquely defined, is part of other models
- **surface model** – wireframe + information about surfaces
- **volume model** – contains information about volume (outside and inside of the solid is known):
 - **boundary model** – solid is described with boundary surfaces and information about volume (Rhinoceros)
 - **construction (CSG) model** – is described as constructions of primitives
 - **dissolution model** – solid is described with small elements, same shape and size (eg. cubes), like bitmap



boundary model



construction (CSG) model