An ontology for CAD data and geometric constraints as a link between product models and semantic robot task descriptions

In this paper, we introduce an approach for leveraging CAD description to a semantic level, in order to link additional knowledge to CAD models and to exploit resulting synergy effects. This has been achieved by designing a description language, based on the Web Ontology Language (OWL), that is used to define boundary representations (BREP) of objects. This involves representing geometric entities in a semantic meaningful way, e.g., a circle is defined by a coordinate frame and a radius instead of a set of polygons.

Furthermore, the scope of this semantic description language also covers geometric constraints between multiple objects. Constraints can be specified not only on the object level, but down to single edges or faces of an object. This semantic representation is used to improve a variety of applications, ranging from shape-based object recognition to constraint-based robot task descriptions. Results from a quantitative evaluation are presented to assess the practicability of this approach.