AUTOMATIC DESIGN OF GEARS AND THEIR MECHANICAL DRIVE IN BLENDER

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Abstract: *Creation of different types of simulations of moving mechanisms with involved elements as gears is widespread. Depending on the specific needs different techniques which enable the accomplishment of the assignment are applied. Of particular importance is the selection of suitable software system that contains the necessary tools, functional qualities, set of features for automating the drive mechanisms, simulations and animations. Furthermore, it is important to determine the accessibility to such resource. Under these conditions a very good solution is the system with open source Blender.*

Keywords: BLENDER, GEARS 2.0, SIMULATIONS, ANIMATION

1. Introduction

In the design of gears and other machine elements it is accepted to use CAD systems [1 - 3]. According to the functionality the CAD systems are divided into three classes: low, medium, and high [4]. Respectively each of these systems is specific in many indicators. Often developers of software products allow programs to be supplemented with additional capabilities such as: database, specifications of standards, used materials, graphic symbols and characters, as well as ready set of elements, components, and mechanisms. With the rapid expansion of the 3D system Blender, mainly due to the rich set of functionality and free GNU license [5 - 8] there are opportunities wanted for quick design of machine elements, mechanisms, and simulation of various types of mechanical systems and animating processes [9]. This study aims to clarify possible ways of quick design of gears and their drive with subsequent animation.

2. Prerequisites and ways to solve the problem

Blender 3D system itself allows a high-quality design in mesh mode (main difference with Solid CAD systems). When an individual design is applied to gear design it is necessary to consider many basic requirements and mechanical laws typical for machine elements. This design process can be facilitated as to the basic software Blender a specialized Addon - Gears 2.0 is integrated. Typical for Addons in Blender is that they are designed for the relevant version of the program. At this point the actual version is Blender 2.76 (2015). Gears 2.0 is developed in 2014 and is made completely free for use by the developer [8]. Fig.1 shows the path of generating gear models in Blender in sequence of integrating Gears 2.0 Addon to the activation of the application in add/mesh.

Fig. 1 *Integration of Gears 2.0 Addon in Blender*

When generated the initial mesh 3D gear model comes with advance (default) set parameters. Thus facilitates the further definition of the automatic gears model. Fig. 2 shows default 3D generated mesh gear model.

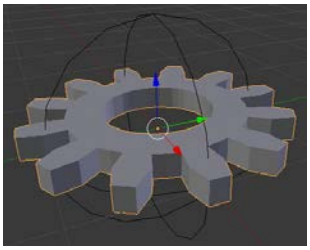


Fig. 2 *Default 3D generated mesh gear model*

Possible parameters for the automated design of gear models are shown in Fig. 3. Panel settings are located in Modyfiers.

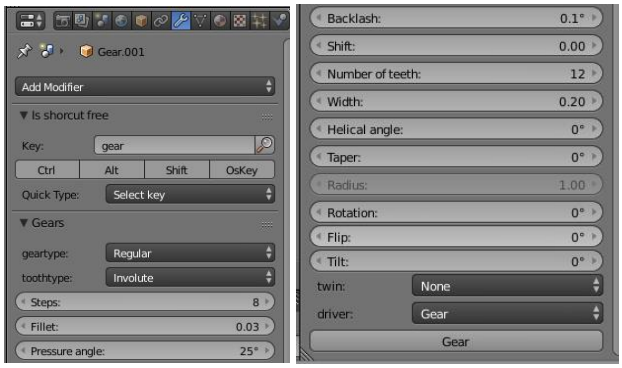


Fig. 3 *Possible parameters for the automated design of gears*

Gears 2.0 Addon allows a precise automated design of Toothing, [10] trough defining the parameters of Pressure angle and Backlash (Fig. 4).

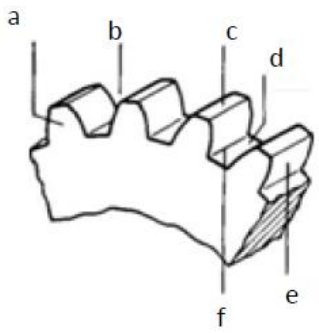
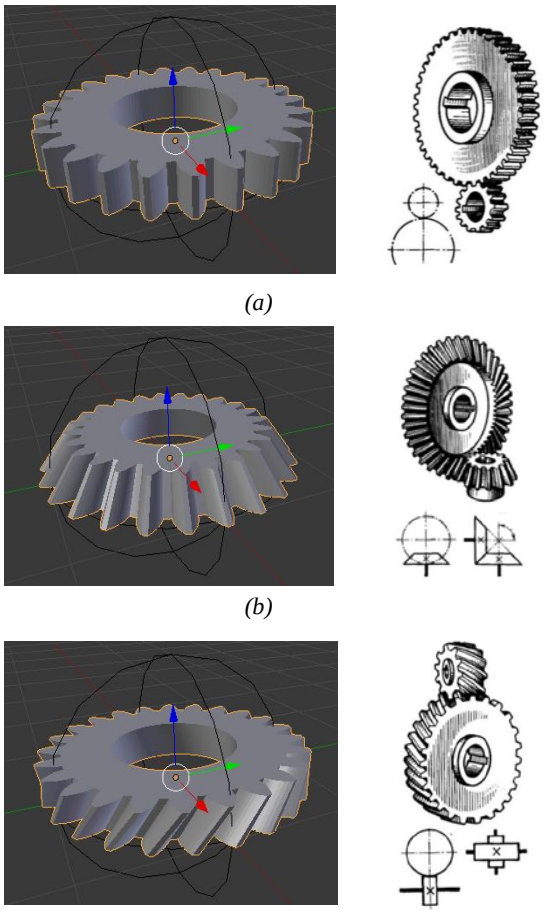


Fig.4 *Toothing (a) tooth (b) tooth space (c) tip surface (d) root surface (e) tooth flank (f) fillet surface*

Fig.5 shows versions of cylindrical, bevel, and helical gears automatically generated in Gears 2.0.



(a)

(b)

(c)

Fig.5 *3D Gears: (a) cylindrical (b) bevel (c) helical*

3. Solution of the research problem

This study's goal is to explore the possibilities of designing gear elements in an environment of Blender software, as the process of creating design of 3D models of gears, simulation and animation is supported automatically. Fig. 6 shows the defined configuration of the simulation of driving the cylindrical gears.

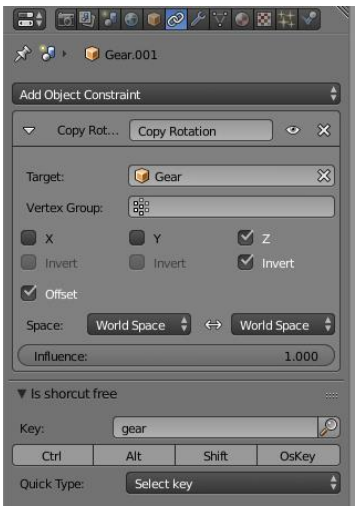


Fig. 6 *Configuration of mechanical cylindrical gearing simulation*

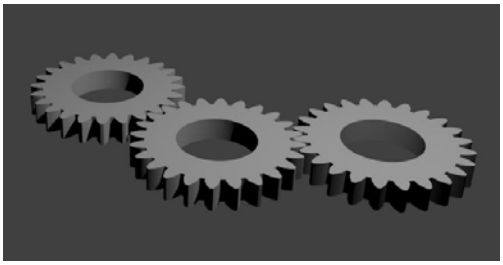


Fig. 7 *Simulation of 3D model cylindrical gearing*

4. Results and discussion

The resulting simulation of drive of cylindrical gears is made in a relatively short time. The possibilities of computer aided design through additional tools help constructing 3D models of gears in a more effective way. According to the assignment the cylindrical gearing system is textured and animated, using the powerful resources of Blender software.

5. Conclusion

In the present study a simulation of driving cylindrical gears is generated, using the specialized module for automatic support in the design of gears "Gears 2.0" Addon. The generated simulation is subsequently animated by rigging of 3D models. The final version of the resulting model is used to support engineering design, through quality visual presentation of powered mechanical gears elements.

6. Literature

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