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DEVELOPMENT OF A GEAR DRIVE DESIGNER SOFTWARE

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Abstract: The paper deals with the programming and introducing the function of a new program for designing gear drives. The main goal of the program is to provide the exact machine setting parameters for producing a given gear drive. The software is a multi purpose tool for fast industrial calculations and pre-analysis.

Keywords: *gear design, gear calculation, gear design*

1. INTRODUCTION

Due to the modern industrial machining tools and automated production chains, new product manufacturing requires less manual intervention. Although it is a more convenient and productive approach than making all adjustment manually but fine tuning a product becomes much harder. The main reason behind this fact is that the machinery manufacturers try to hide the exact calculation methods and settings from the customers as a trade secret, only letting a limited setting option for the end user. Our program aims several goals. The most important of all is to help the designer and production staff with actual data about the future product in all production phase. To reach this goal the new designer program will be a multipurpose tool. The base program can already make the necessary geometrical calculations of a one step gear drive and provides a few machine settings necessary for manufacturing the gears. The functionality of the program can be extended by further calculation, graphical or analytical modules as needed.

2. BASIC CONSIDERATIONS

With the spread of smart devices, platform independence and efficient resource management in programming is a pressing issue. For this matter our program has been written in pure C language using GTK3 module to create a fast and efficient graphical user interface. By using only standardized programming functions there is a possibility to compile the program to all operating system with small or no modification.

All calculation is based on the ANSI/AGMA 2005-D3 Standards [3] that contains the necessary equations the program is using.

Our future goals are:

– to create a module that is able to calculate the necessary machine settings from the basic geometry data

- to make a graphical module to show the tooth surface changes based on the modification of the machining parameters
- to create a calculation for defining the connection line or point where the 2 gears tooth surface connect.

The main program provides the geometrical data of a hypoid gear drive with two connecting gear.

3. About GTK3

GTK3 [1] is a code and function collection for creating a graphical user interface for any type of programs. It was originally designed for Linux operating systems to help support the software developers to create fast and efficient desktop environments. But it has become an all around tool for graphical interface programming.

The main advantage of GTK3 is the fact, that we can create a low resource requirement and fast system without compromising on the user interface capabilities. This has been achieved by low memory usage and CPU use.

Transition between Linux and Windows or any other operating systems is possible since GTK3 functions are using only standard C code, therefore it can be compiled to any system without any problem.

There are two reasons for making this program for Linux at first. Nowadays, Linux is the fastest OS than can be used on computers so any calculation takes the least possible time on this systems. The second reason is that most modern operating systems are using some element of Linux. Android is based on stable Linux kernel with modifications. Windows and MacOS also has Linux modules used in their systems.

4. The program

Figure 1 shows the main program view.

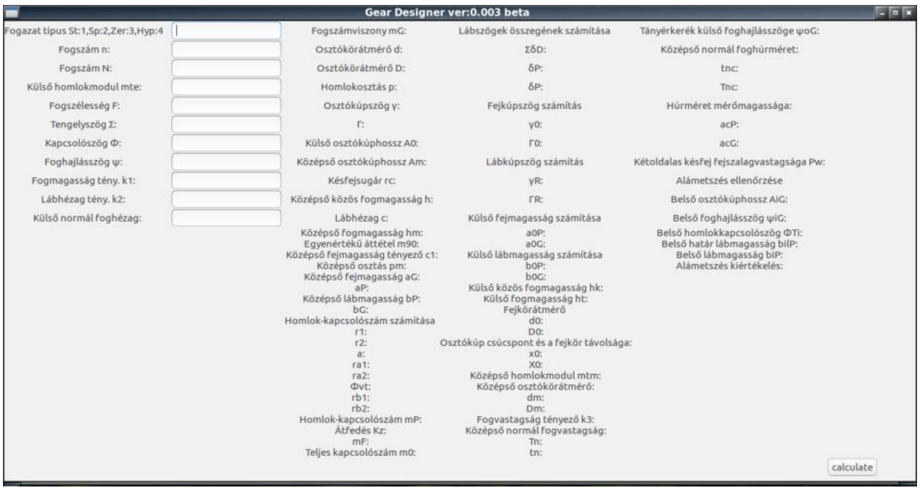

Figure 1. Main program view

The first column contains the necessary input data fields for the calculations.

The system is semi automatic at the moment, i.e, some constants have to be supplied manually as input data but in a few case the program can handle constants automatically based on the other input data without user intervention. One of the future goals is to make the system fully automated, eliminating the need for manually giving the required constants. The whole calculation process is flexible. The program keeps all supplied input data until exit so the users can make new calculations by modifying only the input data of their choosing and press calculate button. Every unmodified input field will keep the original data. There is also the possibility to make partial calculations if the user only need specific geometrical data not a whole calculation. The program will always calculate every viable equation it has adequate data for. The main reason for keeping the original data after the calculation is to speed up the process to create new variants of an already existing drive and analyse de impact of modifications on the original design directly. In this way we can make basic optimisation right after the first calculations.

5. PROGRAM STRUCTURE

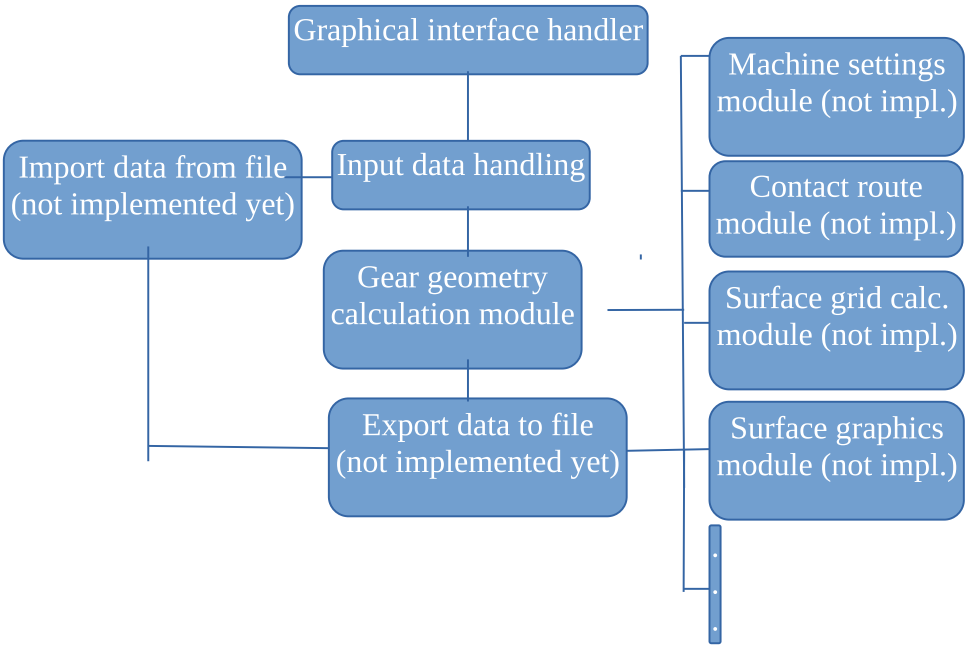

Figure 2. Existing and planned program structure

As *Figure 2* shows, the program has a lot of potential upgrade possibility. Lets us see the test run of the program with a verified input data collection. Currently, only Hungarian user interface is available for the program.

Figure 3. Test input parameters for the program

In *Figure 3* the following parameters can be seen:

- n, N: number of tooth for pinion and gear,
- mte: outer face module,
- F: tooth width,
- Σ: shaft angle,
- Φ: pressure angle,
- ψ: spiral angle,
- k1, k2, B constants from ANSI/AGMA 2005-D3 Standards based on the above mentioned parameters.

The program gives the same results as the manual calculations but precision has been increased for, higher precision calculation purposes. The next figure shows the final test calculations of the test run.

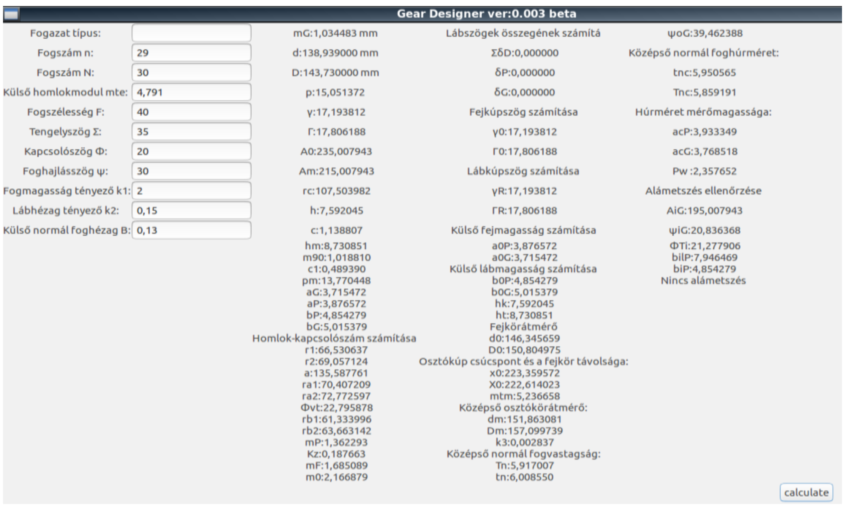

Figure 4. Final test results

The first data field is not an implemented option yet, but it will allow users in the future to choose from different gear tooth types.

6. SUMMARY

Applying the new designer software a lot of viable geometrical variation can be created in a short amount of time. This tool is platform and software independent so no additional tool is required to use it. This feature and the future integration with possible analytical modules makes this program a versatile tool for gear research and optimization problem solving.

The precision of the calculations can be further increased without any negative effect on performance.

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