Engineering process automation to determine the required material hardness of a cylindrical gear in Autodesk Inventor

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Problem statement, initial data and tools

The objective of the study is to automate the engineering processes on the optimal choice of steel hardness for the manufacture of a cylindrical gear transmission with the following initial data (with the possibility of their variation):

- *main parameters:* gear ratio U, transmitted torque at the output link (wheel) T_2, center distance a_w, module m.

- *optional parameters*:

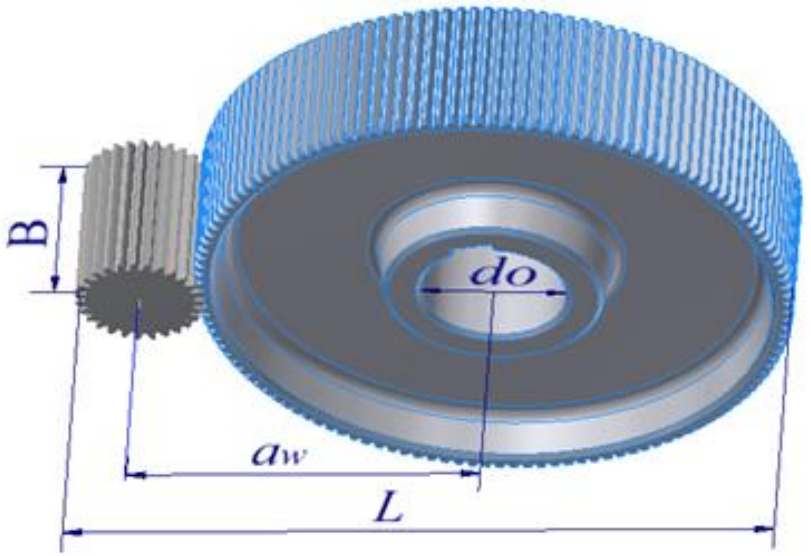
ψ_a - the width coefficient (set depending on the location of the gear pair relative to the supports);

K_a - center distance ratio (for spur gear pairs K_a=49,5, for helical-gear train– K_a=43);

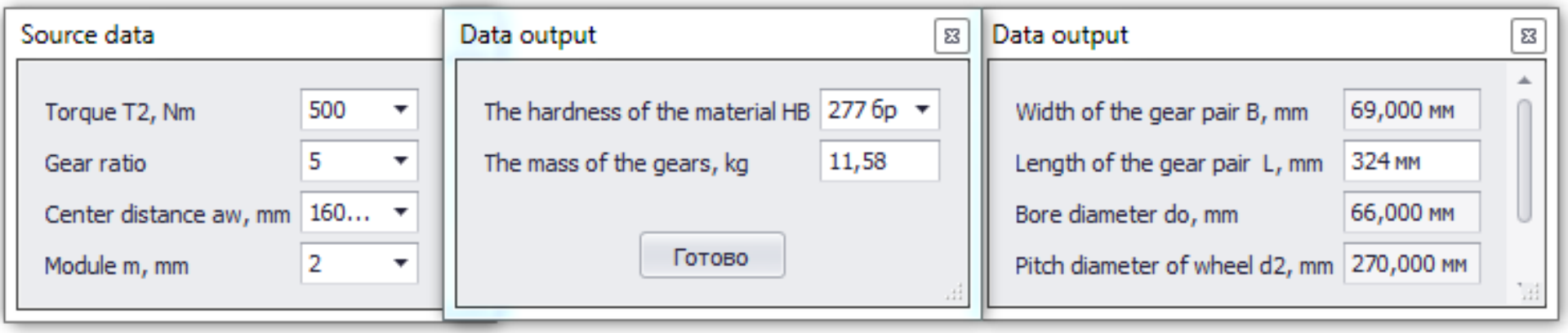
$K_{H\beta}$ - load concentration coefficient (for running-in wheels $K_{H\beta}$=1);

S_H – safety factor.

As the output, in addition to determining the value of the required hardness of the HB material, the physical and geometric parameters of the gear pair parts should be derived: overall dimensions – B and L, reference diameter d_2 and gear mass *mass*.



Using the software product created by the authors, studies were carried out to determine the hardness of the gear pair material for the following initial data: gear pair — cylindrical spur gear, gear location relative to the supports — symmetrical, safety factor S_H=1,1, transmitted torque T_2=250; 500; 710 Nm, gear ration *U=2;2,5;3,15;4;5;* module *m*=2*;* center distance a_w=125;140;160;180.

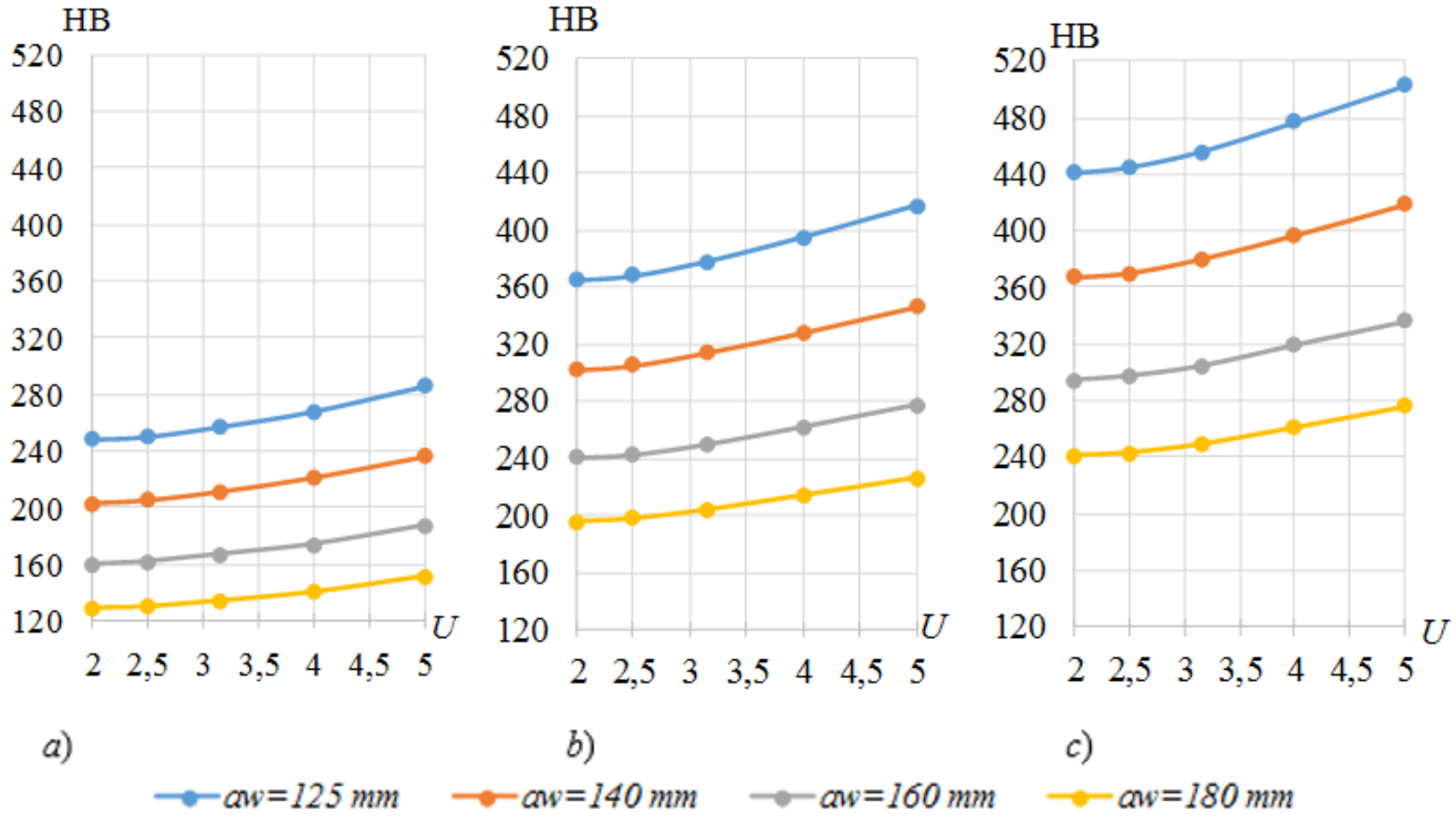


3D parameterization of the gear pair was carried out by assigning geometric parameters depending on the calculation results to the parameter names;

- generators from the parametric parts library *Inventor* are used to parameterize individual elements of the gear wheel and gear: for gear rims - *IGS*; for key ways – *iKPKeywayHub*;

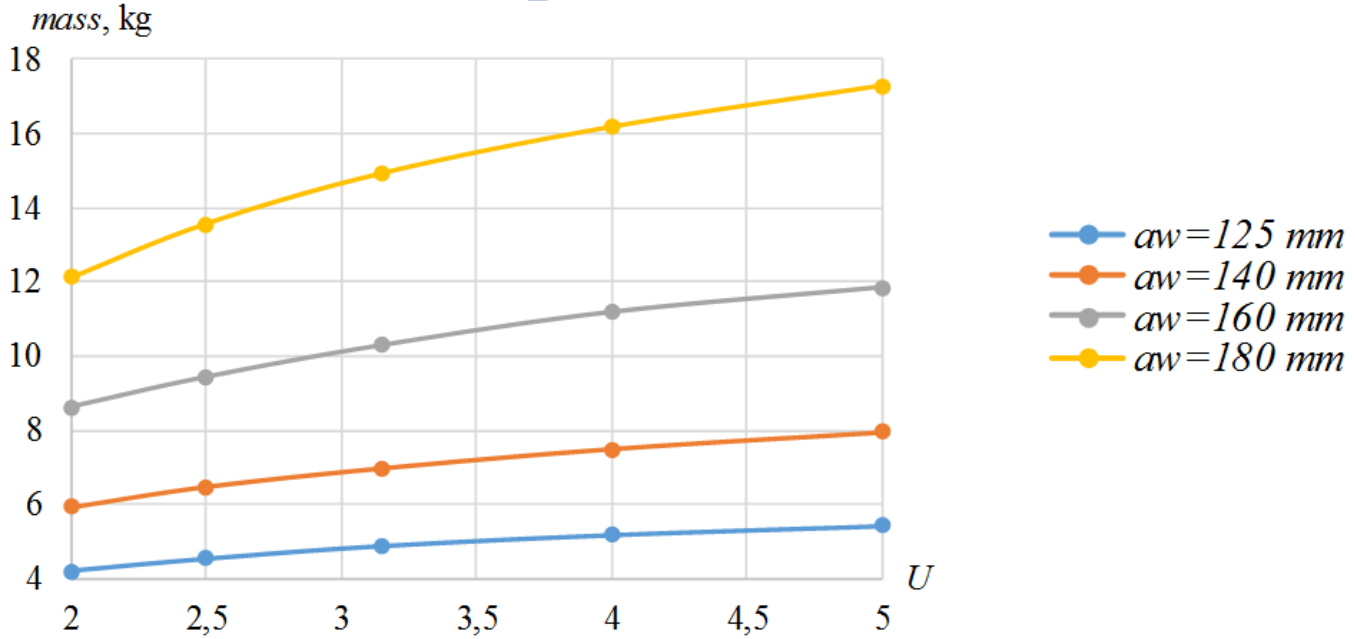
- creation of user interface for inputting the source data and outputting results using forms *iLogic*.

The dependence of the hardness of the material for the gear pair on the gear ratio, center distance and torque



a) T_2=250 Nm; *b*) T_2=500 Nm ; *c*) T_2=710 Nm.

Dependence of gear mass on gear ratio and center distance for torque T2=710 Nm



Conclusion

The speed and convenience of working with the software package allows one to quickly and accurately receive data on the required hardness of the materials for the cylindrical gear pair and mass-dimensional parameters for the full range of transmitted torques, gear ratios, center distances regulated by GOST 25301-95. Such an approach to design makes it possible to make the optimal choice of gear pair material, taking into account customer requirements, already at the early stages of product design.