INTERNATIONAL MULTIDISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
SJIF 2019: 5.222 2020: 5.552 2021: 5.637 2022:5.479 2023:6.563 2024: 7,805
eISSN :2394-6334 https://www.ijmrd.in/index.php/imjrd Volume 12, issue 06 (2025)

KINEMATICS AND MAIN DIMENSIONS OF SPUR GEAR CYLINDRICAL GEARS

Tovashov Rustam Xo‘jaxmat ugli
Doctor of Philosophy in technical Sciences, docent, Karshi State Technical University

Abstract: This article presents theoretical information on the kinematics of spur gear cylindrical gears, their main dimensions, and the forces acting on them, which are commonly used in the field of mechanics.
Keywords: gear wheel, gear, parameters, diameter, forces, kinematics, speed, tooth module, number of teeth, outer, inner circle.

Introduction. Nowadays, in the field of mechanical engineering, in particular in the mechanization of agriculture, the use of gear mechanisms in many agricultural machines is of great importance. The importance of gear mechanisms in this is that they convert the rotational motion coming from the tractor's power take-off shaft into the working part of the machine [1-2]. When adapting the rotational motion to the movement of the working part, it is necessary that the materials and dimensions of the parts of this mechanism can withstand the stresses generated in the environment during movement and ensure smooth movement. For this reason, it is necessary to study the movement of gear transmissions, their parameters and the forces acting on them [3-6].
Research method. Permanently attached couplings can be fixed or movable. Fixed couplings connect the shafts so that they do not slide relative to each other. Movable couplings connect the shafts in a way that allows them to move in different directions [7-10].
Research results and discussions. A gear wheel with a cylindrical gear and a pitch cylinder of the side surfaces of the teeth parallel to the sides of the wheel is called a spur gear [11-13].
Cylindrical gears (Figure 1) belong to direct contact gears.

Figure 1. Cylindrical spur gear

These gears are used at speeds ≤ 2 / .
We determine the geometric parameters [14-15] of spur gear cylindrical gears depending on the module and number of teeth (*t* and *z*).

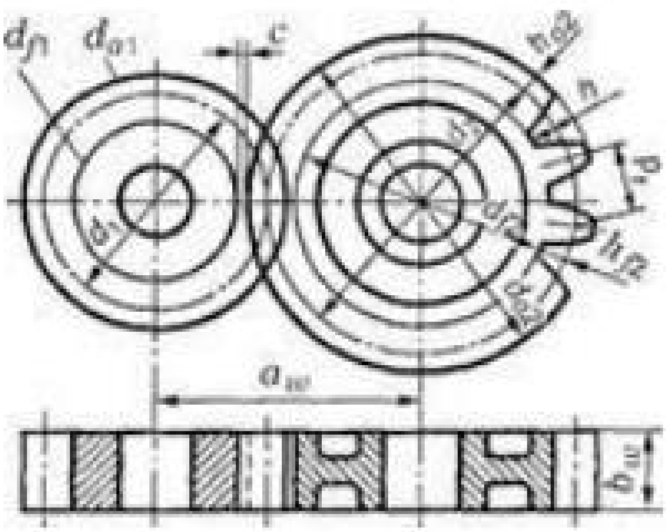

Fig. 2. Main geometric parameters of gear drives with tooth profiles

Tooth tip diameter

$d_a = d + 2h_a$ (1)

Tooth socket diameter

$d_f = d - 2h_f$ (2)

From the equation = , the diameter of the division is:

$d = (\frac{p_t}{n})z$ yoki $d = mz$ (3)

According to the standard, the height of the tooth head is *h* = *m*; the height of the tooth root is *h* = 1.25 ;

The height of the tooth is $h = h_a + h_f = m + 1.25m = 2.25m$.

From here the diameter of the tooth tip

$d_a = mz + 2m = m(z + 2)$ (4)

Tooth socket diameter

$d_f = mz - 2.5m = m(z - 2.5)$ (5)

The difference between the height of the tip of one wheel and the height of the tread of the other creates radial clearance.

$c = h_f - h_a = 1.25m - m = 0.25m$ (6)

The distance between the axes = $_w$

$a_w = \frac{d_1+d_2}{2} = \frac{m(z_1+z_2)}{2}$ (7)

In a gear, the width of the tooth is equal to the pitch length: = m

− tooth length coefficient (tooth width) modulus

The forces arising from the meshing of the teeth are applied to the teeth of the wheels, and then these are transmitted to the joints in which the wheels are mounted, from the shafts to the bearings and other parts [16-19]. To calculate the details listed above, it is necessary to know the magnitude and direction of these forces [20-23].

As shown in the figure, a pair of teeth participate in the connection, and we assume that the connection point coincides with the line N. The load in the tension distributed along the length of the line NN is replaced by the resultant force, which is directed along the connection line NN and is normal to the contours of the teeth at the connection point. Frictional forces in the connection are not taken into account, since they are small [24-28].

For practical purposes, not only the force is of interest, but also its components - the circumferential force F_t, tangent to the dividing circles, and the radial force F_r, directed along the line connecting the centers of the wheels.

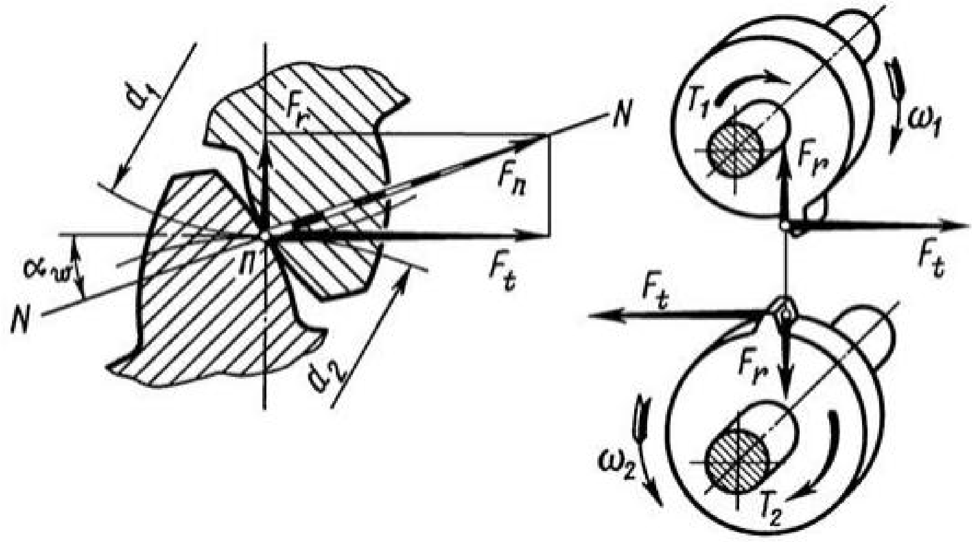

Figure 3. Determining the forces acting on the meshing of gears

F_n is the total force perpendicular to the tooth surface along the meshing line.
From this,

$$F_t = F_n \cdot cos\alpha_\omega = \frac{2T_1}{d_1} = \frac{2T_2}{d_2} = T_2(u+1)/\alpha_\omega \cdot u \quad (8)$$

$$F_r = F_t tg\alpha_\omega \quad (9)$$

Here T_1, T_2 are the torques on the gear and wheel, respectively;
d_1, d_2 - diameters of the gear and wheel pitch of the circle, respectively;
u – number of transmissions.
The direction of force on the driven wheel is in the direction of rotation, and on the leading wheel it is opposite [29-30].
Conclusion. According to the analysis of the theoretical data considered above, the forces acting on the gear mechanisms have a significant impact on the smooth movement of the mechanism, its kinematics. At the same time, the provision of the required torque due to the rotational force acting on the mechanism depends on the main dimensions of the gears, that is, it varies depending on the diameter of their pitch circle.

References

1. Mamatov F. et al. Machine for cultivation and sowing of cereal seeds on sloping fields //AIP Conference Proceedings. – AIP Publishing, 2023. – Т. 2612. – №. 1.
2. Mahamov K. T., Tovashov R. K., Ochilov S. U. Part of the soil surface with minimal tillage analysis of lateral suction techniques and technologies //Academicia: An International Multidisciplinary Research Journal-Kurukshetra. – 2020. – №. 10 (4). – С. 706.
3. Товашов Р. Х. и др. НИШАБЛИКЛАРГА ИШЛОВ БЕРИШ ВА ЭКИШ СЕЯЛКАСИ АРИҚ ОЧГИЧНИНГ ТАЖРИБАВИЙ ТАДҚИҚОТЛАРИ НАТИЖАЛАРИ //Инновацион технологиялар. – 2021. – №. Спецвыпуск 1. – С. 105-108.
4. Kh T. R. Theoretical basis of the crushing angle of the loosening working body blades of the combined machine //Инновационная наука. – 2020. – №. 10. – С. 23-25.

5. Tovashov R. K. Theoretical basis of the installation corner in relation to the direction of movement of the furrow opener working body of the combined machine //РАЗВИТИЕ НАУКИ И ТЕХНИКИ: МЕХАНИЗМ ВЫБОРА И РЕАЛИЗАЦИИ ПРИОРИТЕТОВ. – 2020. – С. 26.
6. Mamatov F. et al. Working body of the machine for sowing cereals on slopes //AIP Conference Proceedings. – AIP Publishing, 2023. – Т. 2612. – №. 1.
7. Mamatov F. et al. Ridge forming machine for sowing cereals on sloping fields //E3S Web of Conferences. – EDP Sciences, 2023. – Т. 401. – С. 04051.
8. Маматов Ф. М., Махамов Х. Т., Товашов Р. Х. Нишаб ерларга ишлов берадиган машина юмшаткичининг тажрибавий тадқиқотлари натижалари //Инновацион технологиялар. – 2021. – №. 1 (41). – С. 27-30.
9. Maxamov XT T. R. X. Tavashov Sh. X., Safarov FS Theoretical basis of the parameters of the base of antique chairs //International Journal of Trend in Scientific Research and Development (IJTSRD), India. – 2022. – Т. 6. – №. 2. – С. 1213-1217.
10. Tovashov R. Нишаб ерларга ишлов берадиган машина корпусининг тажрибавий тадқиқотлари натижалари //Science and innovation. – 2022. – Т. 1. – №. A6. – С. 411-415.
11. Товашов Р. Х., Товашов Б. Р. Результаты экспериментальных исследований рыхлителя сеялки //ИНТЕЛЛЕКТУАЛЬНЫЙ ПОТЕНЦИАЛ ОБЩЕСТВА КАК ДРАЙВЕР ИННОВАЦИОННОГО РАЗВИТИЯ НАУКИ. – 2021. – С. 27-31.
12. Tovashov R. X., Safarov F. S., Maxamov A. U. Theoretical justification of parameters of backrest of antique chair. – 2022.
13. Mirzaev B. et al. Combined machine for preparing soil for cropping of melons and gourds IOP Conference Series: Earth and Environmental Science, 403 DOI: 10.1088. – 1755-1315/403/1, 2019. – Т. 12158.
14. Алдошин Н.В., Маматов Ф.М., Исмаилов И.И., Тавашов Р.., Васильев А.С. Обработка почвы и посев зерновых культур на склоновых полях. Агроинженерия. 2023;25(3):30-34. https://doi.org/10.26897/2687-1149- 2023-3-30-34
15. Xo‘jaxmat o‘g‘li, T. R. . (2023). Nishabli Dalalarga Ishlov Beradigan Va Don Ekadigan Mashinaning O‘Rkach Hosil Qilgichining Harakat Yo‘Nalishiga Nisbatan O‘Rnatilish Burchagini Asoslash. Journal of Innovation, Creativity and Art, 2(2), 27–31.