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CONTACTS

Phone: **+998 50 737 87 88**

Website: https://ist-journal.uz

Email: innovationist2025@gmail.com

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ANALYSIS OF MANUFACTURING METHODS AND TECHNIQUES FOR MULTI-FACETED SHAFTS

Khasanov B.M.
Andijan State Technical Institute, Doctor of Philosophy (PhD)

Valikhonov D.A.
Andijan State Technical Institute, Doctor of Philosophy (PhD)

Abdullaev B.I.
Andijan State Technical Institute, Doctor of Philosophy (PhD)

Alibekov R.K.
Andijan State Technical Institute, Master's student

Abstract: This article analyzes the widespread application of cylindrical components and shafts with multi-faceted external surfaces in mechanical engineering, instrument making, robotics, agriculture, mining, and other industrial sectors. The structural and operational advantages of multi-faceted shafts, particularly those with square, hexagonal, and other regular polygonal cross-sections, are examined. Practical examples of the use of such shafts for torque transmission in various industries are presented, and their advantages over splined and pinned connections are substantiated.

Key words: multi-faceted shafts, polygonal cross-section, torque transmission, square and hexagonal shafts, fastening elements, material utilization coefficient, plastic deformation, mechanical engineering technologies.

Annotatsiya: Maqolada ko'p qirrali tashqi yuzalarga ega bo'lgan silindrsimon detallar va vallarning mashinasozlik, asbobsozlik, robototexnika, qishloq xo'jaligi, kon sanoati hamda boshqa sanoat tarmoqlarida keng qo'llanilishi tahlil qilingan. Xususan, kvadrat, oltiburchak va boshqa muntazam ko'pburchak kesimli vallarning konstruktiv hamda ekspluatatsion afzalliklari ilmiy asosda ko'rib chiqilgan. Turli sanoat sohalarida aylantiruvchi momentni uzatishda qo'llaniladigan bunday vallarning amaliy misollari keltirilib, ularning shlitsali va pinli birikmalarga nisbatan samaradorligi va ustun jihatlari asoslab berilgan.

Kalit so'zlar: ko'p qirrali valllar, ko'pburchak kesim, aylantiruvchi moment uzatish, kvadrat va oltiburchak valllar, mahkamlash detallari, materialdan foydalanish koeffitsienti, plastik deformatsiya, mashinasozlik texnologiyalari.

Аннотация: В статье проведён анализ широкого применения цилиндрических деталей и валов с многогранными наружными поверхностями в машиностроении, приборостроении, робототехнике, сельском хозяйстве, горнодобывающей промышленности и других отраслях. Рассмотрены конструктивные и эксплуатационные преимущества многогранных валов, в частности валов с квадратным, шестигранным и другими правильными многоугольными сечениями. Приведены практические примеры использования таких валов для передачи крутящего момента в различных отраслях промышленности, а также обоснованы их преимущества по сравнению со шлицевыми и штифтовыми соединениями.

Ключевые слова: многогранные валы, многоугольное сечение, передача крутящего момента, квадратные и шестигранные валы, крепёжные элементы, коэффициент использования материала, пластическая деформация, технологии машиностроения.

INTRODUCTION

At present, cylindrical components with multi-faceted external surfaces are extensively employed across a wide range of economic sectors, including mechanical engineering, instrument making, robotics, agriculture, mining, and medical technology. In engineering practice, the effective operation of mechanical systems is

inseparably linked to the use of fastening elements of various types and dimensions, many of which feature external surfaces defined by regular polygonal cross-sections. Among these, externally hexagonal bolts are the most common [5–6]; their manufacture is technologically straightforward, as they are produced from rolled hexagonal blanks and generally meet dimensional accuracy requirements up to the 12th tolerance grade.

At the same time, special hexagonal components requiring higher dimensional accuracy, reaching the 10th tolerance grade, as well as bolts and nuts with bearing rings [2–3], are also widely used. The production of such components is more technologically demanding and cannot be carried out using rolled hexagonal blanks. In addition, fastening elements such as flange nuts [6] are applied, in which the diameter of the polygonal section is smaller than that of the cylindrical portion, allowing for improved functional integration within assemblies.

The manufacture of high-strength fastening elements, including bolts of strength class 8.8 and higher used in the automotive industry, requires the application of medium-carbon alloy steels (35, 40, 40X, 38XA, 40XN2MA, 38XGNM), as well as economically alloyed boron-containing steels such as 12G1R, 20G2R, 30G1R, and 35G1R. Although the use of these materials increases the technological demands of plastic deformation processes [4], it significantly enhances the operational reliability and durability of the finished products. Along with hexagonal fasteners, mating square-section keys are also widely utilized in engineering practice [3], contributing to efficient torque transmission and reliable positioning.

Multi-faceted torque-transmitting shafts likewise occupy an important role in modern engineering systems. Leading manufacturers in the global pump equipment market recommend the use of polygonal connections between impellers and shafts, as such solutions simplify assembly operations while ensuring high operational performance and reliability [1]. In crank-type hot forging presses (KISHP), torque transmission from the drive to the main working mechanism is achieved by installing a central hub with a profiled fit onto a shaft featuring a prismatic end with a square cross-section. The required interference at the contact surfaces between the shaft and the hub is formed using two plate-shaped wedges, ensuring stable operation under load [5].

In truck crane slewing mechanisms, the rotating structure is manually actuated through an intermediate shaft with a protruding square-shaped end, where rotation is transmitted via a matching key. Shafts with multi-faceted surfaces are also widely applied in torque sensor designs, as well as in instrument-making applications, including low- and high-voltage equipment and automatic ventilation systems, where polygonal-section shafts provide reliable torque transmission.

Experimental testing conducted during oil well drilling using the TPV-195 turbodrill demonstrated the high efficiency of the developed hydraulic downhole motor design. Torque transmission from the rotor to the shaft through a hexagonal interface proved to be stable and reliable, with no detectable signs of frictional damage at the contact surfaces. No three-faceted wear was observed at the stepped turbine ends, even when the spindle operated with a clearance of approximately 10–12 mm, and the service life of the two-section TPV-195 turbodrill reached approximately 250 hours [2].

The adoption of such profiled connections in mass production is primarily обусловлено their clear advantages over splined and pinned joints [1]. Shafts with polygonal profiles exhibit approximately five times higher resistance to cyclic loading compared to splined shafts of identical diameter, while the absence of splines and pin holes contributes to increased torsional stiffness, particularly in square-profile shaft connections. Triangular-profile shafts and corresponding holes are widely used in passenger railcar locking mechanisms and keys [2], whereas square-shaped shanks are commonly applied in metal-cutting tools such as drills, milling cutters, and reamers [4]. Square shafts are also employed for torque transmission in industrial robots, including the “Universal-5 OM” model.

Traditionally, multi-faceted surfaces are formed by milling using indexing devices or by shaping with cam mechanisms [5]. While these methods provide satisfactory geometric accuracy, their productivity remains limited [6]. Given the extensive use of polygonal cross-section components across numerous industrial sectors, the development of new, efficient, high-productivity, and cost-effective methods for forming multi-faceted surfaces remains a highly relevant and strategically important engineering objective.

LITERATURE REVIEW

The application of polygonal cross-section shafts in mechanical engineering is primarily associated with their high load-carrying capacity, reliable torque transmission, and stable operational performance. Numerous scientific studies substantiate the advantages of such shafts over splined and pinned connections, emphasizing their superior structural strength, torsional rigidity, and extended service life. In particular, the works of Valikhonov and co-authors analyze the efficiency of machining processes and the influence of material properties, demonstrating the necessity of improving technologies for forming multi-faceted surfaces.

In addition, studies conducted by Fayzimatov and other researchers place special emphasis on the role of geometric shape in material cutting and deformation processes. These investigations scientifically justify

the potential for increasing the material utilization coefficient and reducing waste during the production of multi-faceted components. Collectively, the cited scientific sources provide a solid theoretical foundation for deepening the geometric and technological analysis of polygonal shafts and for further advancing their manufacturing methods.

RESEARCH METHODOLOGY

In this study, both theoretical and practical analytical methods were employed to investigate the geometric and technological characteristics of polygonal cross-section shafts. At the initial stage, the principal geometric parameters of shafts with regular polygonal cross-sections—including internal and external radii, side length, angular values, and cross-sectional areas—were determined using mathematical formulations. During the calculation process, the geometric relationships arising from variations in the number of facets were analyzed, and their influence on material consumption was systematically evaluated.

In the practical part of the research, the useful and waste cross-sectional areas formed during the shaping of polygonal shafts from the initial blank were calculated. Based on the obtained results, the material utilization coefficient was determined, and its dependence on the number of facets was presented in the form of tables and graphs. The proposed methodology provides a reliable basis for assessing the efficiency of polygonal shafts and offers practical guidance for improving their manufacturing technologies.

ANALYSIS AND RESULTS

In engineering practice, nearly all multi-faceted shafts used in mechanical engineering possess cross-sections in the form of regular convex polygons. Accordingly, such shafts are characterized by a well-defined set of geometric parameters, including internal and external radii, side length, interfacial angular values between adjacent faces, and other related characteristics. This geometric regularity provides a reliable basis for analytical modeling, comparative evaluation, and the optimization of manufacturing processes.

$$\alpha = 180\frac{(n-2)}{n}$$

Here, n denotes the number of sides of the polygon.

If the radius of the circumscribed circle is known, the radius of the inscribed circle can be determined.

$$r = R \cdot cos\frac{180}{n}$$

Figure 1.1. illustrates a hexagon.

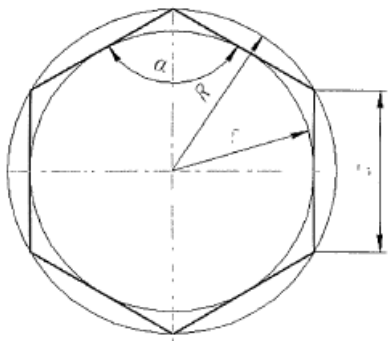

Figure 1.1 – Shape of the hexagonal cross-section.

a – side length of the polygon; r – radius of the inscribed circle of the polygon; R – radius of the circumscribed circle of the polygon; S – area of the polygon; α – angle between adjacent sides.

If the radius of the circumscribed circle is known, the radius of the inscribed circle can be determined.

$$r = R \cdot cos\frac{180}{n}$$

The side length of the polygon is equal to:

$$\alpha = 2R \cdot sin\frac{180}{n} = 2rtg\frac{180}{n}$$

The area of a regular polygon with n sides and side length a is determined using the following formula:

$$S_n = \frac{1}{2}R^2 \cdot n \cdot sin\frac{360}{n}$$

Table 1. The main parameters of the most commonly encountered regular polygons

Number of sides	Angle	Circumscribed circle radius	Inscribed circle radius	Area
3	60	$\frac{a\sqrt{3}}{3}$	$\frac{a\sqrt{3}}{6}$	$\frac{a^2\sqrt{3}}{4}$
4	90	$\frac{a\sqrt{2}}{2}$	$\frac{a}{2}$	a
5	108	$\frac{a}{10}\sqrt{10(5+\sqrt{5})}$	$\frac{a}{10}\sqrt{5(5+2\sqrt{5})}$	$\frac{a^2}{4}\sqrt{5(5+2\sqrt{5})}$
6	120	a	$\frac{a\sqrt{3}}{2}$	$\frac{3a\sqrt{3}}{2}$
8	135	$\frac{a}{2}\sqrt{2(2+2)}$	$\frac{a}{2}(1+\sqrt{2})$	$2a(1+\sqrt{2})$
10	144	$\frac{a}{2}(1+\sqrt{5})$	$\frac{a}{2}\sqrt{5+2\sqrt{5})}$	$\frac{5}{2}a^2\sqrt{5+2\sqrt{5})}$

Based on the parameters of geometrically regular polygonal shapes, the material utilization coefficients (MUC) were calculated using the formulas presented above for the process of forming polygonal shafts. The diameter of the initial blank was machined to the size of the circumscribed circle characterizing the polygonal cross-section of the resulting shaft, after which it was shaped into a polygon inscribed within this circle. The obtained results were summarized in Table 2, and on the basis of these data, a graph illustrating the dependence of the MUC on the number of facets was constructed (Table 2).

Table 2. The percentage ratios of the cross-sectional areas of the blank, the finished part, and the chips (swarf), as well as the dependence of the material utilization coefficient (MUC) on the number of facets

N	3	4	5	6	7	8	10	12
S_{zag}	100%	100%	100%	100%	100%	100%	100%	100%
S_{det}	41,35%	41,35%	41,35%	41,35%	41,35%	41,35%	41,35%	41,35%
S_{qir}	58,65%	58,65%	58,65%	58,65%	58,65%	58,65%	58,65%	58,65%
MFK	0,41	0,41	0,41	0,41	0,41	0,41	0,41	0,41

Here, N denotes the number of facets of the regular polygon in the cross-section of the part; S_{zag} is the cross-sectional area of the blank machined to match the dimensions of the polygonal shaft; S_{det} is the actual cross-sectional area of the finished part; S_{qir} - is the area of the portions removed from the blank cross-section during the formation of the polygonal shaft and converted into chips (swarf) (Figure 2).

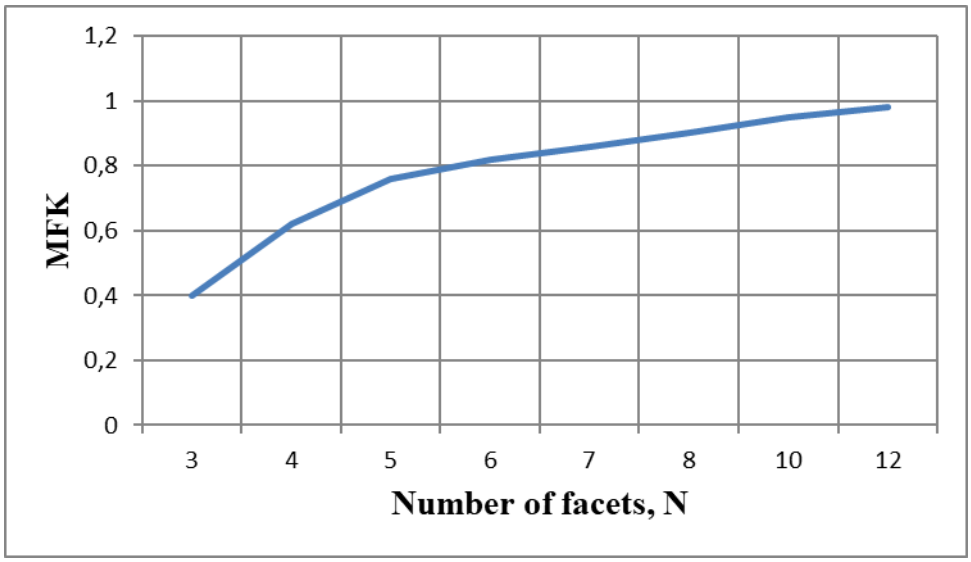

Figure 2. Graph of the dependence of the material utilization coefficient on the number of facets.

As can be seen from the graph, an increase in the number of facets leads to a corresponding increase in the material utilization coefficient. Consequently, a higher number of facets contributes to a reduction in production costs for such components. However, an increase in the number of technological operations also affects manufacturing productivity. Based on this, it can be concluded that there is a need to develop new machining methods that allow all facets to be formed simultaneously.

CONCLUSIONS AND RECOMMENDATIONS

Shafts with multi-faceted external surfaces, including square, hexagonal, and other regular polygonal cross-sections, provide high reliability and load-bearing capacity in torque transmission and demonstrate notable structural and operational advantages over splined and pinned connections. Geometric analysis of polygonal cross-section shafts indicates that an increase in the number of facets results in a higher material utilization coefficient, thereby reducing material consumption and enhancing the economic efficiency of manufacturing processes.

At the same time, considering the limited productivity of conventional machining methods, the development of new high-performance and cost-effective technologies capable of simultaneously forming all facets of multi-faceted surfaces represents a relevant, constructive, and promising direction for further scientific research and industrial implementation.

REFERENCES

1. Fayzimatov, S. N., Xusanov, Y. Y., & Valixonov, D. A. (2021). Optimization conditions of drilling polymeric composite materials. The American Journal of Engineering and Technology, 3, 22–30.
2. Xusanov, Y. Y., & Valixonov, D. A. O‘g‘li. (2021). Polimer kompozitsion materiallardan tayyorlangan detallarni parmalashning asosiy ko‘rinishlari. Scientific Progress, 1(6), 1169–1174.
3. Dostonbek, V., & Salimaxon, N. (2021). The effect of scraping and surface cleaning on the dressing process during the cutting of polymer materials. ACADEMICIA: An International Multidisciplinary Research Journal, 11(6), 717–721.
4. Dostonbek, V., Nizomiddin, J., & Jurabek, S. (2021). Experimental and theoretical studies of the process of cutting polymer materials. Academicia Globe: Inderscience Research, 2(5), 485–490.
5. Fayzimatov, Sh. N., Ergashev, I. O., & Valikhonov, D. A. O‘g‘li. (2022). Effects of crushing on cutting and surface cleaning in the processing of polymer materials. Eurasian Research Bulletin, 4, 17–21. Retrieved from https://www.geniusjournals.org/index.php/erb/article/view/353.

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