

# Language Features of Russian Texts of Engineering Discourse

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## **Abstract**

The Article is devoted to the applied problem of identifying the linguistic features of engineering texts. The study of Russian-language texts of engineering discourse is usually of an applied nature, in our case, this applied research is caused by the need to teach foreigners who receive professional engineering education in Russia and in Russian language. The object of the research is the Russian-language texts of textbooks and manuals of engineering specialty "Robotic systems". The logical-component features of the engineering texts organization are described. The basis for the study of features can be a dictionary database of engineering texts, namely catalogs of frequency words. The method of creating a catalog of frequency words is presented. The source material for this study were the texts on the engineering specialty "Robotic systems", created for the purpose of teaching students of this profile. In total, about 10 thousand pages of authentic texts were processed. The catalog of frequency vocabulary includes about 2000 units. On the basis of this analysis, the substantive, verbal, adjectival, adverbial groups and the group of service parts of speech were identified. Quantitative analysis allowed to identify the most popular grammatical classes of words that are found in Russian engineering texts, and to describe the features of their functioning in engineering texts. Currently, the results of the research allow us to come to the statement that engineering communication is a special kind of Russian-language speech universe. The method of analysis of texts of engineering specialties, based on the study of the most frequent vocabulary, is not exhaustive in order to see all their specific language features, but makes it possible to track the most striking features inherent in this class of scientific texts. The Appendix contains a catalogue of frequency vocabulary in the engineering specialty "Robotic systems".

**Keywords:** Engineering Discourse; Teaching Foreign Languages; Russian as a Foreign Language.

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## **1. Introduction**

The research of engineering discourse texts, unlike the texts of other areas, for example, fiction, is usually applied. In our case, the interest to this type of speech production is due to the need of component analysis of the text material, with the help of which it is possible to identify its specific linguistic features. Identification of the language features of Russian-language engineering texts is necessary for teaching their creation and understanding of foreign students studying at Russian technical universities. Therefore, Russian texts of engineering discourse are the subject of special scientific interest of teachers who work with foreign students studying Russian as a means of education in Russian. It can be assumed that the linguistic study of engineering texts as an integral part of the Russian-speaking communicative space is largely associated with the search for answers to the linguistic and didactic question of how to improve, modernize methods of teaching Russian to foreigners in Russian technical universities.

## **2. Literature Review**

It should be noted that engineering communication in Russian began to attract the attention of linguists relatively not long time ago. It can be said that the texts of scientific discourse were studied in general in order to identify specific features that are characteristic of written scientific texts. Engineering communication was not of particular interest to linguists and was by default regarded as an integral part of scientific discourse.

Currently, the research conducted by Russian scientists and the results obtained by them allow us to come to the statement that engineering communication is a special kind of Russian-language speech universe. Avdeeva (2005) identified, and in the work of Kosterina (2016) clarified the logical and component features of the organization of engineering texts. These include such elements as the concept of the object, the Genesis of the object, the quantitative and qualitative characteristics of objects, the formulation of the problem, the formulation of the problem, the solution of the problem in ideal conditions and in real conditions, evaluation of solutions, evaluation of the effectiveness of the decision.

In different works (Levina, 2003, 2008; Vasil'eva, 2000, 2005, 2006) the basic syntactic models used in the construction of oral and written statements of engineering communication participants are collected and described. Repeatedly implemented in attempting to produce catalogues of the frequency lexicon utilities (Artem'eva, 2004; Vasil'eva, 2006; ZHarov, Klimova, & Kuznecova, 2003; Lohwater, 1990).

Studies in linguistic purpose text engineering material discourse allow us to identify and describe the linguistic features of engineering texts. The basis for the study of these features can be the lexical Fund of Russian engineering texts, namely catalogs of frequency vocabulary, compiled on the material of the study of large amounts of engineering texts. In this article we are talking about the linguistic specificity of Russian engineering texts obtained on the basis of the analysis of the frequency vocabulary of the array of texts in the specialty "Robotic systems".

### 3. Methodology

To identify the linguistic features of the Russian-language texts of engineering discourse, a technique, based on the analysis of the frequency vocabulary used in this communicative and professional sphere was chosen. The original idea of the study was to see what lexical units engineers most often use in their speech. We were interested in the number of these lexical units and their grammatical characteristics.

In order to implement the idea of the study, it was necessary to select the frequency vocabulary and make a catalog of the most frequently used units, which in linguodidactics is called the lexical minimum.

The lexical minimum in the specialty "Robotic systems" was made as a result of processing of the dictionary material of 26 textbooks for universities and textbooks written by different authors, with a total of 164,523 word uses. When developing the lexical minimum, the computer program Wordstst was used, which allowed to create a rating of words by frequency of use. The basis of the catalog is the principles of frequency, word-formation productivity, high lexical valence, taking into account the terminological nature of the word. It should be noted that these principles (except for the terminological nature of the word) are indicated as the main ones and developers of lexical minima of general knowledge of Russian as a foreign language (Andryushina, 2011, 2018). When developing the lexical minimum on the specialty "Robotic systems" was also taken into account the factor of language Mature students foreign students, so vocabulary items, which are consistent with those reflected in the lexical minimum of the total Russian language proficiency levels A1 and A2 of the final version of this branch the lexical minimum of the excluded. The full lexical minimum in the specialty "Robotic systems" includes 1 700 words.

It should be noted that when compiling the lexical minimum, some errors were allowed, which may lead to a slight distortion of the results. Firstly, only written texts are used for analysis and oral speech is not taken into account. Secondly, since the basis for the selection of sources was the marking of a specialty rather than

specialization, it can be assumed that the volume of speech material covering a particular specialization is not equal, which can lead to an error in determining the frequency of use of terms. In other words, if the total amount of text material in the entire database of sources devoted, for example, to the theme of the electric drive, exceeds other topics, it is expected that the terms of this scientific field will be nominally more, and there will be more than use of one term.

What's more, since the lexical minimum is limited, it is not possible to introduce all terminological units into it. To overcome this problem, it is necessary to create terminological minima.

Moreover, the error in the calculations is associated with the technical capabilities of Wordstat, the errors described above contribute a certain amount of subjectivity to the formation of the lexical minimum, but can hardly significantly affect the final result.

The catalog of frequency vocabulary is a material for the analysis of linguistic features of engineering texts. On its basis, the component composition of the language content of engineering texts is analyzed, the characteristics of individual classes of parts of speech presented in the catalog are identified and described.

#### 4. Results

Creation of the catalog allowed to reveal lexical and grammatical features of the language landscape of the professional and communicative sphere "Robotic systems". These features should be taken into account when developing teaching materials on the Russian language for foreign students receiving professional training in this specialty.

##### ***4.1. Linguo-Didactic Description of the Lexical Minimum in the Specialty "Robotic Systems»***

In order to study the grammatical features of the lexical minimum, five catalogues were compiled, including groups of words of different parts of speech: substantive, verbal, adjectival, adverbial and catalogue of official parts of speech. A comparative analysis of the volumes of these directories is presented in Table 1.

Table 1. *Ratio of Parts of Speech*

Part of speech	Noun	Adjective	Verb	Adverb	Service
% of the total amount of words of the lexical minimum	52%	23%	20%	2,4%	2,6%

Morphological analysis of the lexical minimum showed that the proportion of nominal parts of speech is 2/3 of the total volume of vocabulary material, while the total proportion of the substantive group of this lexical minimum is much higher than the proportion of any other morphological group: In General, this ratio of nominal and verbal parts of speech is usual for the texts of engineering discourse, as previously written in the scientific literature (Levina, 2003; Vasil'eva, 2005). Engineering and technical texts, being part of the General scientific discourse, in a large number use descriptive communicative strategies, the task of which is to represent the multidimensional characteristics of the object under study, so engineering texts in General belong to the typological class of texts-descriptions, which is reflected in the construction of statements. Therefore, the syntax of the engineering text prefers verbs to descriptive phrases "verb + noun", in which the traditional verbal semantics is distributed between two independent lexical units – a verb that does not name the action, but only nominates the fact of its presence, and a verbal noun that expresses the essence of the described process, for example, to perform an action, provide movement, perform rotation, etc.

#### ***4.2. Verb Group***

Let us consider the peculiarities of the verbal group of this lexical minimum. The catalogue of verbal vocabulary, ordered by the number of uses, revealed the following patterns. The most frequent are the verbs related to the General scientific block of vocabulary which reflects not specific to the described communicative sphere of action, and General logical. Imagine the rating of the first thirty on the frequency of occurrences of the verbs: to be (there are several different Russian words equivalent to English verb to be), to have, to follow (you should), allow, define, implement, include, submit, consider, use, depend, provide, get (get), require, use, happen, give, lead, show (shown), to relate, to contain, to produce, to find, to include, to exist, to notice, to be Special verbal vocabulary reflecting the cognitive-conceptual field of investigated communicative spheres, shifted in the second half of this directory: to strengthen, to hold, to break, to recognize, to play, to run, to customize, to vary, to design, to induce, to discharge, to assign. It is obvious that the composition of the verbal group clearly falls into two categories – general scientific, often with a vague meaning, vocabulary and industry vocabulary, with the most common first category. This fact confirms the thesis that the grammatical structure of the sentences of the engineering text is based on substantive dominants, which is why the total volume of verbal vocabulary is small compared to the volume of nominal vocabulary.

#### ***4.3. Substantive Group***

Catalog of substantive vocabulary, also ordered by the number of word use, allowed to identify other patterns. The first thirty nouns clearly indicate the subject

of the lexical minimum: robot, control, system, movement, coordinate, device, manipulator, speed, work, time, scheme, axis, moment, drive, current, engine, number, movement, communication, link, object, position, point, value, equipment, part, mechanism, mobility, element, equation. Even the above set of words shows that in the substantive group as well as in the verbal one, there are two categories – General scientific and branch - but unlike the verbal group, both categories belong to the sub-language of natural Sciences. Another important feature of the substantive group is that 39% of its composition consists of verbal derivatives, which are considered as verb forms by some Russian linguistic schools. The frequent use of verbal derivatives is associated with the predominance of descriptive predicates over verbal predicates in the syntactic structure of sentences of engineering texts.

#### ***4.4. Adjectival Group***

The adjectival catalogue allows to reveal productive word-formative models of adjectives used in the communicative sphere of robotics. These include models which are derived from nouns with the following suffixes: -N- (rus. perekhod-n-yi – egnl. transition, rus. gabarit-n-yi – egnl. dimensionaonal, rus. zakhvat-n-yi – egnl. gripper, rus. magnit-n-yi – egnl. magnetic, rus. stal-n-oi – egnl. steel, rus. vakuum-n-yi – egnl. vacuum, rus. sensor-n-yi – egnl. touch-sensitive, etc.), -OV/EV- (rus. kolts-ev-oi – egnl. ring, rus. plech-ev-oi – egnl. shoulder, rus. tsifr-ov-oi – egnl. digital, rus. rolik-ov-yi – egnl. roller, rus. lokt-ev-oi – egnl. elbow, rus. pusok-ov-oi – egnl. triggering, rus. vint-ov-oi – egnl. screw, rus. svet-ov-oi – egnl. light, rus. ugl-ov-oi – egnl. angular, rus. tsikl-ov-oi – egnl. syclic, etc.), -ESK- (rus. kinematch-esk-ii – egnl. kinematic, rus. akustich-esk-ii – egnl. acoustic, rus. mekhanich-esk-ii – egnl. mechanical, rus. elektrich-esk-ii – egnl. electrical, etc.), TELN- (rus. predvari-teln-yi – egnl. preliminary, rus. soedini-teln-yi – egnl. connective, rus. koleba-teln-yi – egnl. oscillatory, rus. vrascha-teln-yi – egnl. rotational, rus. tsentrostremi-teln-yi – egnl. centripetal, etc.) -ONN- (rus. kommutatsi-onn-yi – egnl. switching, rus. lokatsi-onn-yi – egnl. radar, rus. navigatsi-onn-yi – egnl. navigation, rus. distantsi-onn-yi – egnl. remote, rus. manipulyati-onn-yi – egnl. manipulation, etc.).

#### ***4.5. The adverbial Group***

The catalogue of frequency adverbs is small compared to the catalogues described above. As it can be seen from Table 1, adverbs make up 2.4%. Almost all adverbs are formed from adjectives by suffixal method with the suffix -O: rus. analogichn-o – egnl. analogically, rus. posledovateln-o – egnl. consecutively, rus. pribliziteln-o – egnl. approximately, rus. poocheredn-o – egnl. alternately, rus. ekvivalentn-o – egnl. equivalently, etc.

#### ***4.6. Group of Service Parts of Speech***

The catalog of service parts of speech includes a list of units specific for the scientific style. The list, ranked by frequency, looks like this: in the case, using, for example, thus type, in the form, in connection, however, relatively, the most, or because, as, except, by, therefore, along, and, with the purpose, thanks, order, etc.

### **5. Discussion**

The revealed features of the Russian-language texts of engineering discourse help to understand the linguistic nature of these texts. Let us present some language features that distinguish engineering communication from other types of speech practices. It is obvious that engineering communication is based on nominative vocabulary, as it uses mainly descriptive tactics in building discourse. Just as in General scientific discourse, engineering discourse is tuned to the description and explanation of concepts and processes, so even movement, which in its natural semantics can not be static, in engineering communication stops, as it is considered not as a fact of being, but as a scientific phenomena, where it is required to describe its structure. Considering the movement, the participant of engineering communication prefers to use in speech instead of turning – to make / perform a turn, instead of moving – to make / perform movement. The results of the study showed that the number of verbal vocabulary is comparable with the number of adjectival vocabulary. In ordinary everyday communication verbal vocabulary takes a much larger place, performing its main function – to report on the action. In engineering texts we see that often the verbal vocabulary performs the function of the substance, i.e. simply nominates the fact of the action, but does not specify this action. The Russian lexical Fund is characterized by the presence of a large number of words with the same root morpheme, which is explained by the high word-formation activity, as the Russian language has a large number of building morphemes – prefixes and suffixes for different parts of speech. This allows native speakers of the Russian language in everyday communication to convey different shades of meaning and shades of emotional relations to the object of communication. However, lexical units included in the core of frequency in engineering communication are often formed by certain morphemes and in accordance with clear word-formation algorithms. The list of these morphemes is not so large compared to the existing set of prefixes and suffixes in the language. Most often, construction morpheme used for forming from a known root word with a specific categorical value. Thus, in the language of engineering communication, verb nouns with a suffix or its variant are often used, for example, preservation, movement, direction. Interestingly, the suffixes of adjectives are most often used for attribution of words to the class of adjectives. The catalogue of frequency vocabulary not only gives an opportunity not only to see some

grammatical features of the language of a certain professional sphere. Taking it into consideration, it is easy to identify the main thematic blocks of the studied communicative sphere, in particular in the field of robotics there is the structure of a mechanical robot, a manipulator as an integral part of a mechanical robot, the degree of mobility of the manipulator, ways to move the robot, robot control system, etc. It is important to note that frequency vocabulary catalogs (lexical minima) are necessary not only as a tool for analyzing a huge database of texts of any professional orientation. They also have other functions necessary for the effective organization of foreign language teaching. Lexical minimum as a separate tool is used in the methodology of teaching foreign languages for several centuries. First developed by Kamensky for the study of the Czech language, it became the object of special scientific study in modern linguodidactics. Balyhina (2003), as one of the founders of the Russian system of testing Russian as a foreign language, believes that the lexical minimum is understood as “a set of words, the number of which is the maximum in terms of students' abilities and the minimum in terms of the language system and allows using the language as a means of communication” (p.159). The lexical minimum allows to solve important linguodidactic problems: first, to limit the infinite speech space of real communication to the limits in which it is possible to study modeling of natural speech behavior, and secondly, to describe the lexical units necessary for the development of certain purposes and for a certain period; third, to accumulate material that allows teachers to understand what to teach, and students – what to study.

The catalogue of frequency vocabulary in the specialty "Robotic systems" presented in the article is the branch lexical minimum, i.e. the lexical minimum in the language of one professional sphere. The branch lexical minimum describes the vocabulary core of speech communication within the boundaries of a given professional discourse. To teach a foreign language, the development of a lexical minimum in the language of the specialty is important primarily because with its help, the infinite lexical space of real communication in a certain professional area is narrowed to the boundaries that allow modeling speech communication in the educational plane. With this approach, educational communication ceases to be spontaneous and acquires a "legitimate" character due to the fact that it is based on a scientifically sound base – the minimum lexical language of the specialty. The characteristics of the lexical minimum described above are a reference point for the development of the apparatus of language and speech exercises. The developed lexical minimum in the specialty "Robotic systems" is the basis for the creation of a manual on the Russian language for foreign students studying in this direction. The manual is focused on the development of both language and speech skills of foreign students and is a synthesis of lexical and grammatical work supported by a large set of exercises and work on teaching types of speech activity: reading professional texts



with their subsequent analysis, creating their own written texts of secondary speech genres and teaching oral speech communication within this professional discourse. Training of professional communication becomes more effective due to the understanding of the main language features of engineering communication identified by the analysis of the lexical minimum.

## 6. Conclusion

Lexical minimum in the direction of "Robotic systems" is a specially selected alphabetical list of words that make up the lexical core of speech communication in the field of robotics. This list is developed for the purpose of the linguistic and didactic description of lexical base of sublanguage of the specified professional area. It provides an opportunity to accurately determine its thematic areas, to develop a set of exercises that allow students to focus on the study of specific features of the language system of the discourse in order to succeed in the perception of texts in the specialty and create their own oral and written speech products in the field of professional communication. The method of analysis of texts of engineering specialties, based on the study of the most frequent vocabulary, is not exhaustive in order to see all their specific language features, but makes it possible to track the most striking features inherent in this class of scientific texts.

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## Appendix

### Catalogue of frequency vocabulary in the engineering specialty "Robotic systems"

Absent, absolute, acceleration, accompany, according to, account, accurate, acoustic, acquire, act, action, active, adaptive, add, add up, additional, affect, affiliate, air, allow, allow, along, along with, alternately, although, amount, analog, analysis, apart from, appear, applied (power), apply, appointment, appropriate, approximately arbitrary, area, arise, artificial, as, as a whole, assembly, assume, asunder, asynchronous, at the heart, automatic, autonomous, auxiliary, average, avoid, await, axis, base, based, basis, be, bearing, because, become, belong, besides, billet, bloc, body, brake, braking, brush, by, calculate, calculated, calculation, call himself, capable, capture, carefully, carrying, Cartesian, case, cause, center, centrifugal, certain, chain, change, chapter, characteristic characteristically, characterize, check, choose, circuit, class, classify, close, closed, coefficient, coincide, combine, common, communication, compare, complex, complex, complicate, component, composition, computer, computing, condition, condition, conditionally, conditioned, conduct, connect, consider, consist, constructive, contact, contain, continuous, contribute, control, conveniently, conversely, convert, convince, coordinate, corner, cost, coupling, course, create, creation, crooked, cross, current, cycle, cylinder, dangerous, data, decide, decompose, deformation, degree, delivered, denote, depend, describe, design, despite, detail, determine, develop, development, device, devoted, diameter, differ, different, differential, digital, direct, direction, disable, discrete, distance, distinguish, do, download, drive, dynamics, each other, effort, elastic, electric, electric drive, electromagnetic, electronic, element, elevated, emergency, energy, engine, enough, enter, environment, equal, equation, equip, equipment, equivalent, error, exactly, example, exceed, except, excitation, executive, exist, expand, explain, explore, expose, expression, external, extreme, facilitate, fair, fall, feature, final, find, firm, fix, flat, flexible, flow, fold, follow, following, food, for example, for the purpose, force, form, formula, freely, frequency, friction, full, fully, function, functional, functioning, fundamental, general, generalized, generator, , geometric, give, group, hand, hang, have, high, highlight, hinge, hold, homogeneous, horizontal, housing, hydraulic, illustrate, image, impact, implement, impose, in case, in connection, in contrast, in general, in particular, in the absence, in the presence, include, includes, increase, independent, industrial, information, initial, input, install, intended, intermediate, internal, irrespective, joint, Just a moment, keep down, key, kinematic, known, large, last, lead, length, level, light, limit, line, linear, link, linked, liquid, listed, load, location, logical, longitudinal, lower, machine, magnetic, main, make, man, manage, management, manipulative,

manipulator, manufacture, mass, material, matrix, maximum, mean, measure, measurement, measuring, mechanical, mechanism, meet, memory, method, minimum, minimum, mobile, mobile, mobility, mode, model, modern, module, most, move, move, movement, movement, much, mutual, nasty, natural, necessarily, necessary, negative, neglect, network, new, node, note, notice, now, number, object, obviously, occupy, occur, on, open, operation, operational, operator, optical, optimal, order, orientation, out of, output, , output (output), own, pair, parameter, part, partially, pass, perceive, perfect, perform, permanent, phase, piston, place, plane, pneumatic, point, position, positioning, possess, possible, potential, power, practically, preferably, preliminary, presence, preset (value), pressure, previous, probably, process, produce, production, program, programming, progressive, property, proportional, proportionally, prove, provide, provide, pulse, purpose, raise, raise, random, range, range, reach, react, ready, real, realize, receive, recognize, recommend, record, rectangular, reduce, reduced, refer, reference, reflect, regard, regulation, relation, relation, relative, relatively, relay, reliability, remain, remaining, remote, render, repeat, replace, represent, reproduce, require, resistance, respectively, result, return, reverse, right, rigid, rise, robot, robotic, robotics, rotate, rotor, rule, satisfy, save, scheme, screw, seek, semiconductor, sensor, sentry, separate, serial, serve, service, shaft, share, short, show, side, signal, significant, similar, similarly, simple, simplify, simultaneous, single, site, size, slave, small, solid, sound, source, space, special, specific, specific, specified, speed, spherical, spot, squeezed, standard, start, starting, static, step, still, straight, strengthen, strictly, structure, subject to, substitute,, succeed, such, supply, surface, surrounding, suspension, sustainable, system, table, tactile, take, task, team, technical, technological, tell, temporal, test, testify, thanks to, the gravity of gravity, therefore, three phase, thus, time, Tong, tool, tooth, top, torsional, total, touch, training, trajectory, transfer, transition, transport, turn, type, type's, ulnar, ultrasonic, under the action, underwater, unite, universal, use, useful, usually, vacuum, value, variable, variable, various, vector6 vertical, view, voltage, volume, watch, wave, way, welding, wheel, wide, winding, with, with reference, with the help, within, work, working, zone.