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A Study on Translation Strategies of Mechanical English from the Perspective of Transformative Translation: A Case Study of *English for Mechanical Engineering*

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Abstract— *The quality of mechanical English translation directly affects the accurate transmission of technical information and the effectiveness of cross-cultural cooperation. Based on the Transformative Translation theory, this paper adopts a mixed research method, integrating perspectives from linguistics, translation studies, and mechanical engineering (an interdisciplinary field) to construct a closed-loop research framework of "theoretical derivation-corpus analysis-strategy construction", aiming to study the language strategies of professional English in mechanical engineering and explore the application of Transformative Translation theory in mechanical English translation. The findings show that the flexibility and purposiveness of Transformative Translation Theory are highly consistent with the needs of mechanical English translation; moreover, the application of seven transformative translation methods (addition, deletion, editing, narration, condensation, integration, and alteration) can effectively solve the problems of verbosity and low readability caused by traditional full translation, providing more practical translation experience for other translators.*

***Keywords*—English for Mechanical Engineering, Mechanical English, Transformative Translation, translation methods, translation strategy**

I. INTRODUCTION

1.1 Research background

With globalization advancing, international exchanges in mechanical engineering have intensified, making mechanical English indispensable for accurate technical information transmission and cross-cultural collaboration. However, its high specialization, dense terminology, and complex syntax pose significant challenges to translators. Traditional word-for-word translation fails to satisfy the multifaceted demands of accuracy, readability, and functionality. Thus, exploring a more suitable theoretical and practical framework is imperative.

Literature and case reviews show the "Transformative Translation Theory" has great potential in technical translation. It emphasizes adaptive adjustments to source texts (via addition, deletion, restructuring, and explication)

based on target audiences' needs—aligning well with mechanical English's challenges (e.g., terminology comprehension, syntactic simplification, cultural discrepancy mitigation). *English for Mechanical Engineering* (Shi，2022) is a classic textbook in this field, integrating theoretical depth and technical practicality, which will be taken as the research object in the study.

1.2 Research objective and significance

This study focuses on the theoretical and practical aspects of mechanical English translation, with both academic and practical value for cross-cultural communication in mechanical engineering.

1.2.1 Theoretical significance

The Transformative Theory provides a new perspective for mechanical English translation research, reflecting translation's functional orientation. It enhances understanding of mechanical English translation's characteristics and offers theoretical guidance to improve translation quality.

1.2.2 Practical significance

It guides practitioners in accurately converting mechanical terms/concepts, enhances translators' efficiency and quality, and provides a scientific basis for complex text translation, boosting practitioners' professional competence.

1.3 Research methods

A closed-loop framework ("theoretical derivation - corpus analysis - strategy construction") is adopted, combining qualitative-quantitative analysis and interdisciplinary perspectives (linguistics, translation studies, mechanical engineering):

1.3.1 Chinese-English Comparative Analysis: Compares terminology (e.g., "tolerance" vs "公差"), syntax (English passives vs Chinese actives), and discourse (English "Question-Method-Outcome" vs Chinese "general-specific-general") via parallel text analysis of typical segments.

1.3.2 Case Study: Selects 3–5 typical cases per text type (technical definitions, operating procedures, troubleshooting) from English for Mechanical Engineering, analyzing steps: marking text features/obstacles, applying strategies, and comparing translation quality.

1.3.3 Interdisciplinary Approach: Uses linguistics (analyzing lexical/syntactic/discourse features), translation studies (designing strategies via Transformative Theory), and mechanical engineering (ensuring terminological accuracy).

1.4 Paper structure

The paper has five chapters: Introduction (background, objectives, methods), Literature Review (research status), Theoretical Framework (Transformative Theory's origin and concepts), Case Analysis (cases from English for Mechanical Engineering), and Conclusion (findings, limitations, suggestions).

II. LITERATURE REVIEW

2.1 Mechanical English translation

Mechanical English is a core subcategory of Technical English, specifically tailored for the fields of mechanical engineering and manufacturing. As a branch of specialized English, it not only inherits the fundamental linguistic characteristics of scientific and technical English (e.g., objectivity, precision, and formality) but also exhibits distinct domain-specific features rooted in mechanical engineering practices.

2.1.1 Term Density and Sentence Complexity

Mechanical English translation requires precise handling of a large number of standardized terms (such as those from ISO/ASME standards), as well as dealing with nested passive sentences and complex modifying structures. Through term classification management (direct translation of core terms, interpretation of derivative terms) and sentence modular decomposition (extracting the main structure + logical clarification), ensure the accurate transmission of technical parameters (such as "tolerance ± 0.02mm") and logical relationships.

2.1.2 Information Reorganization and Function Adaptation

Mechanical English translation needs to dynamically adjust the way information is presented based on the functional goals of the text. For informative texts (such as academic papers), translation should prioritize ensuring consistency in terminology (for example, "finite element analysis" must strictly correspond to "有限元分析") and data integrity (retaining all experimental parameters); While for operational texts (such as equipment manuals), the clarity of instructions should be strengthened. For instance, the passive sentence "The valve should be inspected annually" should be translated into an active sentence

structure "Annual inspection of the valve is required", and layout techniques (such as red font, icons) should be used to highlight safety warnings. In prescriptive texts (such as patent documents), the innovative points should be highlighted through sentence order reconfiguration.

2.1.3 Multimodal collaboration and localization conversion

Mechanical English translation requires the integration of text and graphics for conversion and the adaptation of cross-cultural technologies. Technical documents often contain multimodal information. For example, when translating the text description "Refer to Figure 2A for assembly sequence" in combination with the logical chain of the diagram "Step 1→2→3", it is necessary to ensure that the textual guidance strictly corresponds to the labels of the chart. At the localization level, unit system conversions , differences in safety regulations (such as comparing the North American OSHA standards with the national standard GB 7258), and cultural cognitive differences (such as the direct style of Western technical documents and the preference of Chinese readers for explicit causality chains) need to be handled.

2.2 Research on mechanical English translation

2.2.1 Research status in the world

International research on technical translation primarily revolves around two theoretical frameworks: the functionalist school and localization theory. A representative scholar in this field is Nord (2001), who proposed the "Skopos Theory" (purpose theory), which emphasizes that translational behavior should serve preset goals (e.g., information transmission, operational guidance for end-users) and operates on the core principle that "the end justifies the means." This principle aligns closely with the "reader demand orientation" of transformative translation theory, as both prioritize the target audience's needs over rigid adherence to the source text's form.

Nord further advocated for prioritizing "functional equivalence" (where the target text achieves the same effect as the source text) rather than "formal equivalence" (word-for-word matching) in technical document translation. This viewpoint provides theoretical justification for the rational use of strategies like addition, deletion, and rewriting in mechanical English translation—strategies that are often necessary to clarify complex technical concepts for non-expert readers.

2.2.2 Research status in China

Research on mechanical English translation has long centered on linguistic feature analysis. At the lexical level, scholars focus on terminology standardization; Ye (2000) proposed that standardization should target professional terms and language units expressing specialized concepts, rather than linguistic features themselves. At the syntactic level, studies mainly explore transformation strategies for typical structures like passive voice and non-subject-predicate constructions (Xiang, 2020). In recent years, the discourse function perspective has emerged, with researchers focusing on coherence reconstruction of technical texts and transmission of communicative intentions (Li, 2024).

Since the transformative translation theory system was systematically established, it has steadily expanded its application scope in scientific and technological translation. Early studies focused on concept explanation and methodological construction (Huang, 2011), while recent research has shifted to the empirical dimension: scholars have made progress using eye-tracking experiments to evaluate technical translation comprehension efficiency (Qiu, 2025), corpora to quantify term consistency (Zhang, 2012), and verifying the readability-enhancing effect of compilation strategies in medical translation. These achievements highlight two inspirations: technical translation needs to balance linguistic accuracy and cultural adaptability, and methodology should emphasize data-driven empirical verification.

However, most foreign studies focus on general technical texts (e.g., software interfaces, medical instructions), with limited discussion on high-professional-threshold fields like mechanical engineering, and insufficient in-depth exploration of the systematic application of transformative translation theory.

2.2.3 Challenges in mechanical English translation

Mechanical English translation faces unique challenges stemming from the distinct linguistic and functional features of mechanical texts, which differ significantly from literary or general English texts. Three key challenges in mechanical English translation are as follows:

(1) Balance the Precision of Terminology and the

Complexity of Syntax

Technical texts contain high-density terminology (such as "tolerance stack-up" corresponding to "公差累积分析"), which must strictly follow ISO/ASME standards. However, cross-cultural differences in terminology (such as the need to explain "actuator" in Chinese context as "执行器(动力驱动装置)"), often result in redundant explanations or information loss. Additionally, complex sentence structures with a percentage exceeding 60% of nested passive structures require the translator to break down the logical chain, while maintaining the integrity of technical details.

(2) Functional Adaptation and Multimodal Collaboration

Different text types (such as operation manuals require clear instructions, academic papers need rigorous theories) require dynamic adjustment strategies: operational texts need to convert passive voice to active sentence structure (e.g., "Calibration must be performed" → "Must perform calibration"), while patent translations need to maintain legal rigor. Additionally, graphic-text collaboration requires that chart labels (such as "Fig.3A Assembly Steps") strictly correspond to the text description, and units need to be converted (e.g., "15 psi → 103 kilopascals") and safety symbols (such as OSHA warning symbols → national standard GB symbols) to be changed. Any deviation may lead to technical misinterpretation.

(3) Cultural cognitive differences and conflicts with industry norms

For instance, the direct narrative style of Western technical documents contrasts with the preference for explicit causality in Chinese, and this difference needs to be adapted through the addition of logical connectives for local adaptation; at the same time, balancing international standards (such as ASME Y14.5) with regional practices (such as the Chinese GB/T 1182 geometric tolerance standard) often requires additional annotations, resulting in an overloaded translation information.

III. THEORETICAL FRAMEWORK

3.1 The origin of Transformative Translation Theory

Transformative Translation Theory, pioneered by Chinese scholar Huang Zhonglian (2002), originated from critical reflections on traditional "full translation" methods and practical observations of historical translation practices. In the mid-1990s, Huang identified limitations in conventional approaches that prioritized textual fidelity over functional adaptability, particularly in technical and cross-cultural contexts. Drawing inspiration from Yan Fu's 19th-century translations, which strategically adapted Western texts to meet Chinese socio-cultural needs, Huang conceptualized " transformative translation " (变译) as a reader-centered framework.

Formally introduced at the 1997 International Translation Symposium, Transformative Translation Theory emphasized selective extraction, restructuring, and localized adaptation of source content to address specific audience demands. Huang's systematic work, culminating in the 2002 monograph *Transformative Translation Theory*. Grounded in pragmatism, the theory emerged as a response to globalization's demands for efficient, purpose-driven technical communication, solidifying its role in modern translation studies (Huang, 2002).

3.2 Main concepts of Transformative Translation Theory

3.2.1 Core definition

Transformative translation (translation variant) is a translation activity in which the translator selectively absorbs the core content or part of the original work by means of addition, deletion, contraction, merger, modification, imitation, etc., according to the special needs of specific readers under specific conditions. Its essence is a function-oriented translation strategy, which aims to achieve efficient dissemination and localization of information by flexibly adjusting the form and content of the original text (Huang, 2002).

3.2.2 Translation methods

The translation adaptation activity is an action where the translator adapts and translates the original work according to the specific needs of the readers. The essence of translation adaptation lies in adaptation, which is precisely what distinguishes it from full translation. The adaptation methods can be roughly classified into seven types: addition, subtraction, compilation, narration, reduction, combination, and modification (Huang, 2002).

(1) Addition

Expansion refers to the addition of information based on the original work. The methods of expansion can be divided into explanation - Annotate technical terms or

cultural concepts (e.g., "flange→法兰 (pipe connector)"), commentary - Insert evaluative remarks or background analysis and supplementation Add case studies, diagrams, or analogies (e.g., explaining gear ratios using "bicycle gear shifting").

(2) Reduction

Remove redundant, repetitive, or irrelevant content to focus on critical information. Omit lengthy experimental procedures, retaining only key parameters and eliminate culturally incompatible examples.

(3) Restructuring

Reorganize source content for clearer logic. It includes: selecting a part from the original work and organizing it; arranging the content of the original work in a certain order; writing and organizing the materials provided by the original work and converting them into target language text.

(4) Paraphrasing

Convey core ideas concisely by breaking original sentence structures.

For example: Simplify nested sentences like "The component, which undergoes cyclic loading..." to "部件承受循环载荷，需定期检测"

(5) Condensation

By adopting a new format, the original work is condensed and clarified, achieving a higher quality with less content. This way, reading time is saved and the desired information can be quickly located.

(6) Integration

And "integration" refers to a flexible approach of combining two or more related or logically sequential parts from the original work into one to enhance information density.

(7) Adaptation

This means changing, causing significant alterations to the original work, altering its content or form, including replacing the content or form in the original work with something more suitable for the target language readers, adapting rewriting the original work in another genre based on its content, and transforming modifying the entire original work so that the entire translation is suitable for the new requirements, etc.

These seven strategies—adding, deleting, editing, narrating, condensing, integrating, and altering—collectively optimize information delivery by adjusting volume, refining structure, and ensuring cross-cultural relevance, thereby meeting the practical needs of specific audiences.

3.2.3 Translation principles

Formulate the basic principles (such as integrity and pertinence) and operational methods (such as translation of deleted sentences in paragraphs and inter-article compilation) of translation, emphasizing standardization and operability (Huang, 2002). Transformative Translation Theory, centers on functional orientation and adaptive flexibility, emphasizing that translation should adapt source texts to meet the specific needs of target readers under defined conditions. Its core principles include the following six aspects:

(1) Skopos-Driven Adaptation Principle

The ultimate goal of translation is to fulfill the specific needs of target readers, rather than pursuing absolute textual fidelity to the original. Operational manuals prioritize actionable instructions, academic papers demand theoretical rigor, and patent documents require legal precision.

(2) Selective Extraction Principle

Extract, condense, or expand content based on functional objectives, retaining or enhancing only critical information.

Omission: Remove redundant theoretical descriptions or irrelevant case studies from technical documents; Annotation: Add explanations for culture-bound terms.

(3) Functional Equivalence Principle

The translation must align with the communicative function of the text (e.g., information delivery, instruction execution, legal compliance), rather than pursuing superficial linguistic equivalence.

(4) Dynamic Flexibility Principle

Flexibly employ transformative strategies—such as addition, deletion, editing, condensation, combination, and modification—to dynamically adjust content and form.

Addition: Provide analogies for abstract concepts.

Condensation: Compress lengthy 故障分析 into flowcharts (e.g., "Fault Code E07 → Check Servo Module → Replace MX-2075B").

(5) Reader-Centric Principle

Prioritize the cognitive level, cultural background, and application scenarios of target readers. It contents localization - convert imperial units to metric equivalents and cultural adaptation-replace Western standards with local equivalents (e.g., "compliance with Chinese GB 7258 standards").

3.3 The application of Transformative Translation Theory in mechanical English translation

The proposal of transformative translations stems from the actual practice of translation. Each transformative translation emerges as a result of specific circumstances and has its own applicable scope (Huang, 2011). This determines that the application scope of the translation adaptation theory is quite broad, and the translation strategies vary in different fields.

However, in mechanical engineering translation, this theory proves instrumental in addressing the unique challenges posed by technical jargon, complex syntax, and context-dependent information.

The application of the transformation theory in mechanical English translation has demonstrated remarkable practical value in scenarios such as localizing technical documents, academic exchanges and patent translation, as well as multimodal information integration. It has particularly shown its effectiveness in improving efficiency and achieving cross-cultural adaptation. Moreover, it has gradually begun to penetrate from academic research into the practical field, enjoying high recognition in the academic community but being selectively applied in the industrial sector and lacking standardization. Driven by global demand, in the future, the integration of the transformation theory with AI and multimodal technologies will unleash greater potential, promoting the global technological collaboration to enter a new stage of efficiency and precision.

IV. CASE ANALYSIS

4.1 Addition

The addition refers to the increase of information based on the original work. It includes three method: explain, comment and write (Huang, 2002).

Example 1:

Source Text: "One of the primary considerations in designing any machine or structure is that the strength must be sufficiently greater than the stress to assure both safety and reliability" (Shi, 2022, p35).

Translation with Addition: "在设计任何机器或机构时,所考虑的主要问题之一是其强度应该比它所承受的应力要大得多,以确保安全与可靠性" (Shi, 2022, p274).

Analysis: The meaning of the word "the stress" is "应力", but it can be translated as "它所承受的应力", to assure the accuracy of the meaning conveyed in the text.

Example 2:

Source Text: "The conventional manufacturing processes in use today for material removal primarily rely on electric motors and hard tool materials to perform tasks such as sawing, drilling, and broaching" (Shi, 2022, p115).

Translation with Addition: "在目前所采用的传统加工工艺(如锯削、钻削和拉削加工)中,材料的去除主要是采用电动机和比工件材料硬度高的刀具材料进行的" (Shi, 2022, p291).

Analysis: The meaning of the word "hard tool materials" is "硬的工具材料", but it can be translated as "比工件材料硬度高的刀具材料". If no additional explanation is provided, it may cause readers to be confused about what is meant by "hard".

Example 3:

Source Text: "This is a special programming language for NC that uses statements similar to English language to define the part geometry, describe the cutting tool configuration, and specify the necessary motions" (Shi, 2022, p212).

Translation with Addition: "这是一个专门适用于数控的编程语言,使用类似于英语的语句来定义零件的几何形状,描述切削刀具的形状和规定必要的运动" (Shi, 2022, p315).

Analysis:

The term "NC (Numerical Control)" first appears in the title. In Example 3, it is used in its abbreviated form. However, in order to accurately convey the content and completeness of this professional term, the translator supplemented it and translated "NC" as "numerical control", making the professional vocabulary expression in the translation more rigorous.

And this method is the widest used one. When translating, the translator can, based on the stylistic features of the mechanical English text, analyze the overall context and the surrounding sentences, and add words or phrases

that are not explicitly presented in the sentence structure but are actually implied within the context.

4.2 Deletion

Deletion is to remove from the original text the information content that the translator deems unnecessary for the readers in general. In translation practice, this is manifested as the selection and rejection of parts of the original text (Huang, 2002).

Example 4:

Source Text: "The experimental results (see Table 1, Table 2, and Appendix A) demonstrate a 12% increase in fatigue resistance under cyclic loading conditions, as previously hypothesized in Section 3.2" (Shi, 2022, p48).

Translation with Deletion: "实验结果（见表 1）表明,循环载荷下抗疲劳性提升 12%" (Shi, 2022, p278).

Analysis: Omitted redundant tables and speculative references to streamline technical reporting.

Example 5:

Source Text: "The bearings consist of an inner ring, an outer ring, the balls and the separator (also known as retainer)" (Shi, 2022, p45).

Translation with Deletion: "该轴承由内圈、外圈、球和保持架四部分组成" (Shi, 2022, p276).

Analysis: "Separator" and "retainer" have the same meaning. For the sake of simplicity, and also to prevent readers from over-interpreting the terms, only one of them will be translated.

By eliminating some unnecessary information from the original text, the useful information becomes more prominent.

4.3 Edition

"Edition" here refers to editing, in the theory of translation adaptation, "editing" refers to the process where the translator integrates the text content. By splitting sentence layers and arranging the word order, the translator edits the text to make its logic clear and coherent, develop rationality, be flexible and adaptable, and highlight the logical nature of the translation (Huang, 2011).

Example 6:

Source Text: "At the production-design stage, the primary concern relative to materials should be that they are specified fully, that they are compatible with, and can be processed economically by, existing equipment, and that they are readily available in the needed quantities" (Shi, 2022, p86).

Translation with Deletion: "在生产设计阶段中,与材料有关的主要问题是应该把材料完全确定下来,使它们与现有的设备适应,能够利用现有的设备经济地进行加工,而且材料的数量能够比较容易地保证供应" (Shi, 2022, p287).

Analysis: The main structure of the sentence: The main sentence should be "the primary concern...should be that ...". The subject here is "the primary concern", followed by a prepositional phrase "relative to materials" as a modifier to "concern". The predicate verb is "should be", followed by three dependent clauses introduced by "that", connected by commas and "and".

The second dependent clause is slightly more complex: "they are compatible with, and can be processed economically by, existing equipment". There are two parallel predicate structures connected by commas, and the comma usage in the sentence causes confusion in understanding. These two predicates are in a parallel relationship and jointly act on "existing equipment". The "they are compatible with" and "can be processed economically by" share the same subject "they" and the same object "existing equipment". In this case, it can be understood as "they are compatible with existing equipment" and "they can be processed economically by existing equipment", so the repetitive part is omitted and separated by commas when in parallel.

By using the "edition" technique, the translator can make the content of the text more organized and coherent, thus making it more perfect and accurate (Huang, 2011). Given the extremely complex structure of the original sentence, the translator broke down the sentence layers and then reorganized the text content, helping readers quickly understand the sentence structure and meaning.

Example 7:

Source Text: "ASME B31.3 mandates a maximum operating temperature of 150°C for PVC pipelines."

ISO 14692 specifies PVC chemical resistance grades for industrial applications.

Translation with Deletion: "工业 PVC 管道需符合 ASME B31.3（最高工作温度 150°C）与 ISO 14692（耐化学腐蚀等级）标准。"

Analysis: Merged standards into a unified guideline. Make the text's logic clearer and more coherent.

4.4 Narration

Based on the original content, the expression form of the original work has been changed. All the content is conveyed through narrative language. Therefore, there are summaries and compilations, as well as generalizations (Huang, 2002).

Example 8:

Source Text: "Finite element analysis (FEA) was conducted on the turbine blade using ANSYS Workbench 2023. The mesh convergence study involved 1.2 million tetrahedral elements, and stress distribution results aligned with ASTM E647 fatigue thresholds."

Translation with Narration: "通过有限元分析（FEA）评估涡轮叶片应力分布,结果符合疲劳强度标准。"

Analysis: Simplified technical jargon and omitted software-specific details for a managerial audience.

Example 9:

Source Text: "A rigid body does not change size and shape under the action of forces. Actually, all bodies are either elastic or plastic and will be deformed if acted upon by forces" (Shi, 2022, p2).

Translation with Narration: "刚体在受力之后,其大小形状都不会发生变化。实际上,所有的物体,不管是弹性还是塑性体,在力的作用下都会发生变形" (Shi, 2022, p269).

Analysis: "if acted upon" is actually an abbreviation of "if they are acted upon". It changes the narrative order, moving the postpositional phrase "under" to the front, and omitting the conditional clause introduced by "if" is placed earlier. This form better conforms to the way Chinese people speak and narrate, and is easier to understand in the Chinese translation.

4.5 Condensation

In the theory of translation adaptation, "reduction" refers to the translator's process of compressing the content of the text, using concise and elegant language to express the core viewpoints of the text. When it comes to scientific and technological texts, contraction is particularly suitable for those papers and books that have complex content but few valuable insights (Tian, 2006).

Example 10:

Source Text: "To prevent overheating, ensure coolant flow rates are maintained at 5 L/min, monitor thermocouple readings every 30 minutes, and verify that ambient temperatures do not exceed 40°C" (Shi, 2022, p117).

Translation with Condensation: "防过热措施：冷却液流速≥5 L/min,每 30 分钟记录热电偶数据,环境温度≤40°C" (Shi, 2022, p291).

Analysis: Transform the dull exposition into a more organized form that serves as an operational guide for technicians to follow.

Example 11:

Source Text: "To open or close the guide, it is necessary to unscrew the security bolt and move the security plate (one wrench is needed)" (Shi, 2022, p104).

Translation with Condensation: "如打开或关闭导轨,需拧下安全螺栓并移动安全板（需使用扳手操作）" (Shi, 2022, p290).

Analysis: If the translator directly translates the original sentence in Example 10 as "It is necessary to unscrew the security bolt and move the security plate", it will result in redundant wording and a disordered logical sequence. Therefore, the translator shortened "it is necessary to" to "需" and translated this part as "需拧下安全螺栓并移动安全板". This way, the translation is more in line with the expression style of mechanical texts and is also more concise.

Example 12:

Source Text: "Before the installation, it is required to make a survey in order to find the appropriate position to set the Repeater Unit."

Translation with Condensation: "安装中继器前请检查,以便找到合适的安装位置。"

Analysis: The original text intends to convey the matters that need attention before installation. The translator has shortened "it is required to" and "in order to" to "以便" and adopted the compilation strategy, highlighting the key point of "Please check before installing the repeater". Through the above translation strategies, the translated text is more in line with the reading habits of the general readers.

When translating mechanical English texts, the translator needs to distinguish the primary and secondary elements, highlight the key points, condense the lengthy and complex parts of the original text, and convey more information with fewer words.

4.6 Integration

In the theory of transformative translation, "and" refers to the flexible approach of combining two or more similar or logically sequential parts from the original text into one .

Example 13:

Source Text Fragments:

"Fault Code E101: Hydraulic pressure sensor malfunction (Chapter 4).

Resolution: Replace sensor and recalibrate via HMI interface (Chapter 7)."

Translation with Integration:

"故障代码 E101（液压传感器故障）：

1. 更换传感器（参见第 4 章）

2. 通过人机界面（HMI）重新校准（参见第 7 章）"

Analysis: Integrated troubleshooting steps for faster diagnostics.

Example 14:

Source Text: "A pressure control valve maintains the pressure level by diverting higher pressure fluid to a lower pressure area, or restricting flow into another area" (Shi, 2022, p43).

Translation with Integration: "压力控制阀通过两种方式调控回路中的压力:将高压流体导入低压域;限制流体进入其它区域" (Shi, 2022, p275).

Analysis: The original English text does not explicitly state "two ways", but it is obvious that the content implies this meaning. Moreover, the word "by" in the sentence guides two modifying and restrictive structures. If translated directly, it would sound awkward and affect the meaning of the sentence. Thus, the translated version is clear in structure and easy to understand. When dealing with such parallel relationships, one needs to analyze the internal logical relationship and integrate the original text.

When translating the text, the translator can employ the "and" translation strategy to combine two or more consecutive or logically sequential parts of the text that are of the same type.

4.7 Alteration

In the theory of translation modification, "alteration" refers to the fact that the translator does not strictly adhere to the content and form of the original text. Instead, they abandon the word-for-word translation method and make certain adjustments to some extent, transforming the text into a form that readers can accept, which includes rephrasing, reinterpreting and reworking. Alteration" means to alter, causing significant changes to the original work. It involves modifying the content or form (Huang, 2002).

Example 15:

Source Text: "The device is contraindicated in environments with explosive dust concentrations."

Translation with Alteration: "严禁在粉尘浓度超标的爆炸性环境中使用本设备（依据 GB 3836-2010 防爆标准）。"

Analysis: Added GB standard reference and emphasized prohibition for safety compliance.

Example 16:

Source Text: "The installation of the Weather Station, Wi-Fi Link and Generator Solar Panel has to be done with their cables already connected."

Translation with Alteration: "安装气象站、无线网络链路和发电机太阳能电池板时必须在电缆已连接的情况下完成。"

Analysis: The text describes the specific steps and methods of equipment installation, emphasizing objective and scientific expression. As a static language, English often uses nouns and prepositions to reflect the objectivity of language use; while as a dynamic language, Chinese frequently employs verbs and adverbs. The translator transformed the noun "installation" in the original text into a verb, further highlighting the points that need to be noted during the installation process.

V. CONCLUSION

5.1 Main findings

This paper, from the perspective of the transformation translation theory, systematically explored the strategies and methods of mechanical English translation. The research found that the traditional literal translation method, which involves word-for-word translation, has problems such as excessive information and poor readability in mechanical engineering translations, making it difficult to meet the multiple demands of technical texts for accuracy, functionality, and cross-cultural adaptability.

The seven strategies proposed by the transformation translation theory, namely addition, subtraction, compilation, narration, abbreviation, combination, and modification, can flexibly adjust the content and form of the source text. For example, through term explanations, professionalism can be enhanced; through syntactic restructuring, logic can be simplified; and through cultural adaptation, cross-cultural differences can be eliminated. These strategies not only optimize the efficiency of

transmitting technical information but also take into account the cognitive habits and functional needs of the target readers, providing theoretical support and practical paths for resolving the core contradictions in mechanical English translation.

The research further demonstrated the applicability and innovativeness of the transformative translation theory in the field of mechanical translation. Its core principles-being goal-oriented, selectively extracting key information, and dynamically adjusting the text structure - are highly consistent with the characteristics of mechanical engineering texts. For instance, in operation manuals, the clarity of instructions is emphasized; in academic papers, the strict correspondence of terms is ensured; and in patent documents, the legal rigor is highlighted. By integrating perspectives from linguistics, translation studies, and mechanical engineering, the research constructed a closed-loop framework of "theory derivation - corpus analysis - strategy construction", which not only deepened the understanding of the language features of mechanical English but also provided empirical evidence for the cross-disciplinary application of the transformative translation theory.

Finally, through case analysis, it was found that the transformative translation method can effectively balance the precision of terminology and the complexity of syntax, integrate multimodal information, and adapt to industry norms and cultural differences. In the future, with the deepening of globalization and technological integration, the combination of transformative translation theory with artificial intelligence and multimodal technologies is expected to further unleash potential, promoting the translation practice in the field of mechanical engineering towards more efficient and precise directions, and providing more solid language support for cross-cultural technical exchanges

5.2 Limitations

Although the translation theory has significant advantages in the application of mechanical English translation, it still has limitations.

First, the theory of translation adaptation has been widely applied in the field of literary translation. But, technical English and literary English have different linguistic characteristics, so the translation characteristics and strategies are also different. Scientific translation is about practical results, and it is necessary to convey practical information to the target readers, so it is necessary to first pursue the pragmatic value of the translated work. Therefore, how to reasonably and flexibly apply the strategies and methods of the transformative translation theory to the translation of mechanical English has become the greatest challenge for author when writing this paper.

Secondly, the transformative translation is a new translation theory proposed by Chinese scholars in recent years. Therefore, translators can easily find writing materials as theoretical and exemplary references in Chinese. However, foreign language writing materials are rarely seen in books and websites.

At the same time, almost all books and papers are concerned with technology English, the related mechanical materials are difficult to find. So, it is hard to translate Chinese materials into English.

As the mechanical English text translation has a wide range, there should be easily to find examples to apply for the theory. In fact, it is difficult to find appreciate examples to apply to each kind of transformative translation. For translation strategies that are frequently used and have wide applicability, it is e to find relevant examples, such as: addition and edition; however, for those strategies that are not commonly used, it is more difficult to find appropriate examples, such as modification and combination.

5.3 Suggestions

First, the content of mechanical English translation is highly specialized, and there will be many cases where different professional terms are used interchangeably in the text. Therefore, the translator not only needs to have an understanding of translation strategies, but also needs to acquire knowledge about mechanical professional terms. When translating the text, the translator should not limit themselves to the expression of lexical concepts alone. They should also consider the different meanings of words in different contexts. It is best to combine the translation process with the context and provide necessary explanations for professional terms. By adopting alternative translation methods, the professional terms and expressions should be presented.

Secondly, in terms of translation strategies, the principle of fidelity has been widely accepted. However,

based on the original meaning of this article, translators can boldly adopt flexible and reasonable translation methods using the theory of transformative translation, fully exert their initiative, select appropriate translation strategies, in order to ensure the professionalism, accuracy and conciseness of the translation, which may significantly enhance the translation quality.

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