

## SEMANTIC ASPECT IN TRANSLATING THERMODYNAMIC TERMINOLOGY IN FRANK WHITE'S *FLUID MECHANIC*

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### Abstract

This research aims to find out the semantic aspects found in the translation of thermodynamic terms from English to Indonesian in Fluid Mechanics (White, 1986). In translation, the concept of meaning becomes important to understand as one part that needs to be considered, both lexical meaning, grammatical meaning, conceptual meaning, textual meaning, socio-cultural meaning, and idiomatic meaning. This research method uses a qualitative research design. The book used as the data source is Fluid Mechanics (White, 1986) and its translated version, namely *Mekanika Fluida* (White, 1988). The researcher categorizes the data based on the semantic meanings, namely lexical meaning, grammatical meaning, contextual meaning, socio-cultural meaning, and textual meaning. From the research, it is found that there are three types of meanings based on semantic aspect, those are lexical meaning, grammatical meaning, and textual meaning.

**Keywords:** translation; specialized language; thermodynamic terms; fluid mechanics; semantic aspects

### Pendahuluan

Translation activities are carried out to transfer the message of the source language (SL) into the target language (TL). For example, the transfer of messages from English to Indonesian can be exemplified. Catford (1965, 20) defines translation as "the replacement of textual material in one language (SL) by equivalent textual material in another language (TL)". Catford explains that this definition is intentionally broad, not vague, even though it may seem so at first glance. The use of the term "textual material" underlines the fact that under normal conditions not the entire SL text is translated, that is, it is replaced with its TL equivalent.

The translation of specialized language becomes one of the translators' challenges nowadays. Specialized languages are communication tools used

by modern society to convey their achievements and experiences from generation to generation and from person to person. They use clearly defined concepts and use unambiguous terms. Together with the terms created, eventually form the respective terminology, which reflects the state of human knowledge about the subject area in question (Nedobity, 1983, 69). Pavel & Nolet (2001, xvii) define terminology as "a particular set of words belonging to a science, art, writer, or social entity." In a more specific sense, it means "a linguistic discipline dedicated to the scientific study of concepts and terms used in a particular language." What makes the translation of special languages challenging is that sometimes there are differences in the perspective of each translator, especially for terms that do not yet have a proper meaning in the target language, for

example the word “steady flow” which in the book of *Mekanika Fluida*, is translated by the translator as *aliran tunak*. The word “steady” which has the meaning of *stabil, tetap, mantap, ajek* is translated into *tunak* which has a slightly different meaning from the meaning of the word steady itself.

Each field of science uses its own special language to express the terms it has. One of them is the field of thermodynamics. Thermodynamics is the science of energy, which specifically discusses the relationship between heat energy and work (Ansyah & Ramadhan, 2018, 6). This field is part of the mechanical engineering field that is widely studied by people around the world, especially at the university level.

The field of mechanical engineering has several branches of science, namely mechanics, materials engineering, kinematics, thermodynamics, and energy. There are many mechanical engineering books that have been translated into Indonesian, one of which is Fluid Mechanics by White (1986) which has been translated into *Mekanika Fluida* with M. Hariandja as the translator. One of the things that happened in this area is that the English version of the book has been revised into several editions, but the Indonesian version is only based on the first edition. This is what makes the author choose Fluid Mechanics and *Mekanika Fluida* to be compared because both the English and Indonesian versions of the books have the same content, so it can be seen how the translator translates the book.

In translating a specialized language, linguistic aspects are unavoidable. The concept of translation involves the transfer of linguistic units at the word level to different discourses so that the translation results can be read and interpreted properly. Although not the

only one, the linguistic aspect is important to observe in conducting translation activities and studies. Therefore, there is an assumption that the linguistic aspect is the foundation of translation activities and studies because the meaning and form of the language are transferred (Sriyono, 2018, 273).

In general, aspects of language (linguistics) have an impact on the field of translation both in theory and practice of translation. Several linguistic aspects starting from morphology, syntax and even semantics can support translation both in terms of study and practice. Adequate knowledge of linguistic aspects can reduce the ambiguity of meaning in the source language (SL) to the targeted language (TL) so that it can maximize the results of adequate translation. Therefore, the search for solutions to translation problems cannot be avoided from linguistic problems with both functional and structural paradigms. Thus, an adequate understanding of linguistic aspects becomes an important part for translators (Newmark, 1988).

Linguistics contributes to studying and researching the area of translation, while translation itself is in direct contact with linguistics both at the theoretical and practical levels. The relationship between the two fields illustrates that translation and linguistics can be studied separately or simultaneously (Sriyono, 2018, 274).

Translation activities in studying several linguistic aspects, both in terms of form and meaning. In terms of form, we can examine the phonological, morphological, and syntactic aspects, while in terms of form, we can examine the semantic aspects.

Equivalence of meaning is one of the important things in translation. The meaning can be traced from the semantic system used from the lexical units of

language. A broad and good understanding of semantic concepts can be a means for how a lexicon from the source text can be translated adequately (Sriyono, 2018, 275).

The semantic aspect is closely related to the concept of meaning in translation. In translation, the concept of meaning becomes important to understand as one part that needs to be considered, both lexical meaning, conceptual meaning and other meanings (Nababan, 1999).

Alwasilah (1984, 146) says that "the meaning is behind the word". Meanwhile, Nida (1975, 1) explains that "a word can have various interpretations". In addition, Lepschy in Samiati (1998, 3) reveals that "meaning tends to be used primarily as a way to define linguistic units". Jakobson (1960) in Samiati (1998, 3) explains that "meaning must be investigated in terms of its role as a communication tool, so that the study of meaning needs to refer to various functions relevant to linguistic actions".

An example is the use of the word "run" in the following sentences (Larson, 1984, 8), namely (1) *The boy runs*, (2) *The clock runs*, (3) *The nose runs*, and (4) *The river runs*. These sentences use the same word, namely "run". The sentence "The boy runs" has the meaning of "run" which means "stepping feet quickly which at each step both feet do not touch the ground", "The clock runs" is interpreted as "rotating time", "The nose runs" is translated "The child colds", and the last sentence "The river runs" becomes "The river flows". From the comparison of the four sentences, several different meanings of the word "run" are obtained, namely "run", "rotating", "cold", and "flowing" so that the meaning of one word is not fixed by the form of the lexicon alone, but is also influenced by other factors, for example,

factors of grammatical structure, speaking situation, and background in the field of science.

Samiati (1998, 3) divides meaning into five categories in translation: lexical meaning, grammatical meaning, contextual meaning, textual meaning, and situational meaning. Micro-linguistic context refers to lexical and grammatical meaning, while micro and macro linguistic context refers to contextual, textual, and situational meaning. Nababan (1997, 36-38) categorizes the problem of meaning in translation into five categories, namely lexical meaning, grammatical meaning, contextual meaning or situational meaning, textual meaning, and socio-cultural meaning. The meaning of language elements such as symbols or events, for example, is referred to as lexical meaning. Lexical meaning, also known as dictionary meaning, considers all terms in a dictionary, regardless of their usage or context. For example, as an adjective, the word 'bad' can have six meanings, namely 'evil', 'bad', 'ugly', 'difficult', 'unpleasant', and 'rotten'.

Grammatical meaning is the opposite of lexical meaning, which states that meaning is independent of context. The relationship between linguistic parts in larger units is called grammatical meaning. He gives an example of using the word 'can'. The word can mean 'to be able to', 'container', and 'to put food and drink into a closed metal container without air', depending on the position of the word in the sentence. The use of the word 'can' in the sentence 'They can the fish' is different from the use of the word 'can' in the sentence 'He kicked the can hard'. The meaning of a word in relation to the situation of language users is known as contextual or situational meaning. "Contextual meaning is the relationship between the utterance and the situation in

which the utterance is used contextually," explained Kridalaksana (1984, 120). For example, saying 'Good Morning' to greet employees who are late to the office. The word can be interpreted as 'out' if the one who says the boss is angry and irritated.

The meaning of a text or conversation is referred to as textual meaning. The meaning of the term may also vary depending on the type of content. The word "morphology" has different meanings in biological literature and in linguistic literature. While the socio-cultural meaning is the meaning of a word that is closely related to the socio-cultural users of the language. The word 'marhusip' is used as an example because he is Bataknese. The word 'whispering' in the Toba Batak language has a much larger and more nuanced meaning because it refers to the cultural setting of marriage (Pelawi, 2009).

In analyzing the meaning of words, it is usually distinguished between denotative meaning and connotative meaning (Yusuf, 1994, 93). Denotative meaning is a general and objective meaning that is not associated with particular content, value, or taste. Connotative meaning, on the other hand, is subjective in the sense that there is another meaning hidden behind the general meaning. Beekam and Callow (in Larson, 1984, 110) use the word primary meaning and secondary meaning. Primary meanings are meanings that come to mind when speakers of a language hear a word alone, but secondary meanings are meanings that change depending on the situation.

Research related to translations and semantics has been conducted by some of the previous researchers. Pelawi (2009) published an article titled "Aspek Semantik dan Pragmatik dalam

Penerjemahan" (Pelawi, 2009). In his results, he concluded that related to the translation, he classified meaning into 6 types, namely (1) lexical meaning is a meaning that tends to refer to the meaning in the dictionary, namely the independent meaning as it is; (2) grammatical meaning is the meaning of a word because of the influence of the use of the sentence structure used; (3) contextual meaning is the meaning of a word or sentence because of the situation in the use of language; (4) textual meaning is the meaning that arises or is obtained from the content of a text or certain reading; (5) socio-cultural meaning that is very closely related to culture and social relations in society; and (6) idiomatic meaning is meanings related to special expressions that already have special meanings. The author only tried to find the categories of semantic meaning and define each category.

Vandepitte also published an article titled "Semantic and pragmatic meanings in translation" (Vandepitte, 2007). Vandepitte analyzed the translation pairs between English and Dutch. She found three types of differences on semantic and pragmatic aspects between those two languages, namely (1) implication, it is implied that Dutch predicate lacks a semantic feature; (2) explicitation, the target text is sometimes more explicit than the source text concerning the causal nature of the prediction: the predicate, for example, maybe openly causative, whether through the use of a periphrastic verb or not.; and (3) change is when the concept for the source text agent has attributed a different thematic role in the target text.

From some of the articles published discussing semantics in translation, the writer would like to discuss the types of semantic meaning found in

thermodynamic terms between the English version in the *Fluid Mechanics* book and the translated one, *Mekanika Fluida*. This research has not been discussed yet, especially when we discuss specific terms. By bringing up the existing data, the authors provide examples of data, then categorize the data based on the type of semantic meaning.

### **Research Method**

This research method uses a qualitative research design. Bogdan & Biklen (1998, 27-30) stated that qualitative methodology is a research procedure that produces descriptive research reports in the form of written or spoken words from people and observable behavior. Milles & Huberman (1984, 36) stated that qualitative research can work with a smaller sample than the state of the total population. This means that this research will only take samples of thermodynamic term translation data from the *Fluid Mechanics* book and then analyze them related to the semantic aspects.

The book used as the data source is *Fluid Mechanic* (White, 1986) and its translated version, namely *Mekanika Fluida* (White, 1988). Actually, this *Fluid Mechanics* book has been published until the 9th edition in 2021, but the translated version in Indonesian is the 1st edition of *Fluid Mechanics*, and there is no latest translated version yet. This Indonesian translated version of the book is still widely used, and can still be used because there are not many changes in each edition.

This research begins by collecting data. The research data collected is the terminology in the field of thermodynamics contained in the reference book, then compared between the terms in English and the results of their translation into Indonesian. The glossary of terms is used as primary data by researchers.

This data collection uses the note-taking technique. Note-taking techniques include recording, categorizing, and clarifying the data obtained (Mahsun, 2005, 133) from written sources.

Furthermore, based on the primary data obtained, the researcher will conduct data analysis. Data analysis in this study will be the answer to the formulation of the problem. Data analysis through manual methods, namely by analyzing the data that has been collected and categorizing it into several categories. In this case, the researcher categorizes the data based on the semantic meanings, namely lexical meaning, grammatical meaning, contextual meaning, socio-cultural meaning, and textual meaning.

### **Result and Discussion**

The problem of meaning in translation can be grouped into six categories based on the various ideas and opinions above: lexical meaning, grammatical meaning, contextual or situational meaning, textual meaning, sociocultural meaning, and idiomatic meaning.

However, based on the findings in the *Fluid Mechanics* book, in which we found 514 data of thermodynamic terms, the researchers found only three meanings in the thermodynamics terminology, those are (1) lexical meaning, (2) grammatical meaning, and (3) textual meaning.

#### ***Lexical Meaning***

Lexical meaning usually refers to a dictionary definition, that is, meaning that stands alone as it is. The word "sentence", for example, can mean 'group of words' or 'punishment', because the terms are still autonomous, so they cannot be distinguished. Other influences have little effect on the word. Lexical meaning (from the word lexicon: essentially word) is the meaning we find in dictionaries in general

(Machali, 2000, 24). In the translation of thermodynamic terms found in the book Fluid Mechanics and Fluid Mechanics, some of the translation results are translated lexically. Here are some examples of translations that use lexical meaning:

- (1) SL: First, **viscosity** increases the difficulty of the basic equations, although the boundary-layer approximation found by Ludwig Prandtl in 1904 has greatly simplified viscous-flow analyses.

TL: *Pertama, **kekentalan** meningkatkan kerumitan terhadap persamaan-persamaan dasar, walaupun penghampiran lapisan batas yang ditemukan oleh Ludwig Prandtl pada tahun 1904 benar-benar telah menyederhanakan penganalisisan aliran kental.*

- (2) SL: Prandtl points out that fluid flows with small viscosity, e.g. water flows and airflows, can be divided into a thin viscous layer, or **boundary layer**, near solid surfaces and interfaces, patched onto a nearly inviscid outer layer, where there Euler and Bernoulli's equations apply.

TL: *Prandtl menunjukkan bahwa aliran fluida yang kekentalannya rendah, seperti aliran air atau aliran udara, dapat dipilah menjadi suatu lapisan kental atau **lapisan batas** di dekat permukaan zat padat dan antarmuka, dan lapisan luar yang hampir encer yang memenuhi persamaan Euler dan Bernoulli.*

- (3) SL: If the control volume is moving uniformly at **velocity** ..., an observer fixed to the control volume will see a relative velocity ... of fluid crossing the control surface, ...

TL: *Kalau volume kendali itu bergerak dengan **kecepatan** tetap ..., seorang pengamat yang diam terhadap volume kendali itu akan melihat kecepatan nisbi ...*

*dari fluida yang melintasi permukaan kendali, ...*

- (4) SL: We do not build a million-dollar airplane and see whether it has enough lift **force**.

TL: *Kita tidak membangun pesawat udara seharga satu milyar rupiah untuk melihat apakah pesawat itu memiliki **gaya** bubung yang cukup.*

- (5) SL: Since the block sides are unsupported, element A has zero stress on the left and right sides and compression **stress**...

TL: *Karena balok itu bebas, unsur A tidak mengalami **tegangan** pada sisi dan sisi kanannya, sedang sisi atas dan sisi bawahnya mendapat tegangan mampatan...*

From the examples above, the translator of the Fluid Mechanics book translates the terms in the thermodynamics field lexically, for example, the word "viscosity" is translated into "viscosity". Viscosity is defined as the quality or state of being viscous (= thick and sticky and not flowing easily) or in this case something that is sticky and cannot flow easily. Therefore, the word translates to "*kekentalan*" in Indonesian. The word "*kental*" is defined as "between liquid and hard; concentrated (not liquid); almost frozen." The two words have the same meaning between SL and TL. The word "boundary", according to the dictionary, is a real or imagined line that marks the edge or limit of something.

In Indonesian, the word boundary is translated as "*batas*" which means "line (side) that becomes the boundary of a field (space, area, and so on); separator between two fields (space, area, and so on); border". The word "layer" is a level of material, such as a type of rock or gas, that is different from the material above or below it, or a thin sheet of a substance. In

Indonesian, this term is translated as "lapisan", i.e. "arrangement; row; the section", so that "boundary-layer" translates to "lapisan batas". There is a match between SL and TL. Velocity is the speed at which an object is traveling, in other words, is the speed of an object. This word is translated into "kecepatan", so it fits between SL and TL. Turbulent involves a lot of sudden changes, arguments, or violence and is translated into "bergolak". The word "golak" has the same meaning as "bubble" in Indonesian, so there is a match between SL and TL. The word "force", according to the dictionary, is in scientific use, (a measure of) the influence that changes movement. In Indonesian, this word is translated into "gaya" which means "push or pull that will move a free (unbound) object". In this case, there is a match between SL and TL. These terms are translated according to their meaning in the dictionary, so they are not affected by the context of the sentence. Even when the word is translated outside the sentence, it will still have the same meaning.

### **Grammatical Meaning**

The grammatical meaning of a word is determined by the influence of the sentence form used. The word 'sentence' in the sentence "It is an active sentence" and "At least a sentence provides subject and predicate" has a different meaning from the word sentence in the phrase "The sanction can be fine, a jail sentence, or both". Grammatical meaning is the meaning that is formed as a result of the arrangement of words or phrases, clauses, or sentences, for example, the meaning that is formed because of the suffix added to the words "meminjam" and "meminjamkan" in Indonesian, which in English becomes "to borrow" and "to lend" (Machali, 2000, 24). In the terminology of

the field of thermodynamics, several terms that have grammatical meanings are determined by the class of words. Here are some examples of terms that have grammatical meanings:

(6) SL: The Romans built extensive aqueduct systems in the fourth century B.C. but left no records showing any quantitative knowledge of **design** principles.

TL: *Bangsa Romawi membangun sistem talang air yang meluas dalam abad keempat SM tetapi tidak meninggalkan catatan-catatan yang menunjukkan pengetahuan kuantitatif tentang asas-asas perancangan.*

(7) SL: The great majority of our analyses are concerned with laminar flow or with turbulent flow, and one should not normally **design** a flow operation in the transition region.

TL: *Kebanyakan analisis kita terkait dengan aliran berlapis atau aliran bergolak, dan seyogyanya kita jangan merancang aliran untuk beroperasi di daerah transisi.*

The word "design", if applied as a verb, means "to make or draw plans for something". If applied as a noun, it will mean "a drawing or set of drawings showing how a building or product is to be made and how it will work and look." In Indonesian, the word "design" which is applied as a verb, is translated into "merancang" where there is a prefix "me-" in the word "rancang". While the word that acts as a noun is translated into "perancangan" by the prefix *pe-* and the suffix *-an* in it.

(8) SL: Fourth, if heat ... is added to the system or **work** ... is done by the system, the system energy ... must change according to the energy

relation, or first law of thermodynamics.

TL: *Keempat, kalau kalor ... ditambahkan ke sistem itu, atau **usaha** ... dilakukan olehnya, energi sistem ... tersebut harus berubah menurut persamaan energi atau hukum pertama termodinamika.*

- (9) SL: Thus, a seemingly complicated pressure-force problem can be simplified by subtracting any convenient uniform pressure ... and **working** only with the pieces of gage pressure which remain, as ...

TL: *Jadi, soal gaya tekanan yang kelihatannya sulit dapat disederhanakan dengan mengurangi sembarang tekanan seragam ... dan hanya **menggarap** tekanan tolok (gage) yang tersisa saja...*

The word "work", if applied as a noun, it will mean "the material used by someone at work, or what they produce". If applied as a verb, it will mean "to succeed gradually in becoming something or cause a person or thing to become something, either by making an effort or by making many small movements". In Indonesian, the word "work" which is used as a noun is translated into "usaha", while the word that is used as a verb is translated as "menggarap" or has the same meaning as "mengerjakan" with the affix "me-" as a form of the verb from the root word "kerja".

### **Textual Meaning**

The meaning that comes from or is derived from the contents of a text or reading is

referred to as textual meaning. As pointed out earlier, the word "sentence" is an example. Of course, when reading about language, the term has to do with the use of the sentence and its context. If the word is found in legal literature, its connotations will of course lead to punishment and its surroundings. The book Fluid Mechanics includes many terms that have textual meaning because they are a special language, which is indeed used in the field of thermodynamics. Sometimes there are terms that sound general but will have different meanings when put into the context of reading the book. Here are some terms in the field of thermodynamics that have a textual meaning:

- (10) SL: Such a fluid is called a continuum, which simply means that its variation in **properties** is so smooth that the differential calculus can be used to analyze the substance.

TL: *Fluida semacam ini disebut kontinum (continuum), yang artinya tak lain bahwa perubahan **sifat-sifatnya** sedemikian rupa berangsur sehingga kalkulus diferensial dapat dipakai untuk menganalisis bahan tersebut.*

The word "properties" has a lexical meaning, namely "property" or "owned". In the context of thermodynamics, the word "properties" is translated into "*sifat-sifat*". In the Cambridge online dictionary, the word "property" has other meanings, besides "possession" and "residential area", namely "certain physical or chemical characteristics of a substance". Therefore, in this context, it is interpreted as "*sifat*".



(11) SL: Books on **heat** transfer ... are essentially devoted to finding the temperature field from known velocity fields.

TL: *Buku-buku tentang pemindahan **kalor** ... pada hakekatnya menerangkan cara memperoleh medan suhu dari medan kecepatan yang diketahui.*

The word "heat" has a lexical meaning, namely "*panas*". In the context of thermodynamics, the word "*panas*" is more often replaced with the word "*kalor*" which actually has the same meaning. This is found in several kinds of phrases, for example "heat transfer" is translated to "*perpindahan kalor*", "heat flow" is translated to "*aliran kalor*". There is a specific difference between the terms "*panas*" and "*kalor*". "*Panas*" is more often translated into "thermal" which is the energy possessed by an object at a certain temperature, while "*kalor*" is the process of transferring heat energy through a temperature difference.

From the explanation of the finding above, the authors conclude that of the six existing semantic meanings, in the translation of this Fluid Mechanics book, the authors only find the three most common semantic meanings found, namely (1) lexical meaning, (2) grammatical meaning, and (3) textual meaning. This is because the effort of translating the text from English into Indonesian in this Fluid Mechanics book is mostly done lexically, especially for the translation of the thermodynamic terms. In addition, the translation of sentences in the text is also much more grammatically adjusted, considering that English

grammar is almost the same as Indonesian grammar. There are not many other semantic meanings found, especially for idiomatic and socio-cultural meanings because the translation of terms in the field of thermodynamics does not use cultural adjustments from the source language into the target language.

### Conclusions

Translation is one of the most exciting disciplines of applied linguistics to work in. The goal of translation is to convey the message from the source language (SL) to the target language (TL) (TL). The transfer of messages from English to Indonesian, for example, is an example. Nowadays, specialist language translation is one of the translators' challenges. Each branch of science has its own vocabulary for expressing its terms. The field of thermodynamics is one of them. Linguistic aspects are unavoidable when translating a specialist language.

The concept of translation entails the transfer of linguistic units at the word level to various discourses in order for the translation results to be properly read and interpreted. Appropriate linguistic understanding can lessen the ambiguity of meaning in ST to ST, maximizing the results of adequate translation. In translation, the semantic component is strongly linked to the concept of meaning. In translation, the concept of meaning becomes important to understand as one part that needs to be considered. Based on the findings in the Fluid *Mechanics* book, the researchers found only three meanings on the thermodynamics terminology, those are (1) lexical meaning, (2) grammatical meaning, and (3) textual meaning.

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