National Technical University of Athens

Synthesising from different sources

Week 5

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The tasks

- The texts in the following slides were produced by 4th semester students from previous years.
- The task was to write a coherent text (~170 words) using information from 4-5 different excerpts.
- The following texts have been chosen to illustrate:
  - some typical problems students might run into when synthesising information from different sources, and
  - some examples of good academic writing practices.

Marking criteria

- 1. Plagiarism (5%)
  - The original texts have not been plagiarised.
  - Appropriate paraphrasing, summarising and synthesising.
  - Appropriate use of citations based on relevant style guide.
- 2. Content and organisation (5%)
  - The text is well-focused and relevant to the task.
  - The structure is appropriate (e.g. from general to specific).
  - Main ideas are clearly outlined.
- 3. Language (5%)
  - The text is coherent and cohesive.
  - The language is academic (using formal vocabulary, appropriate research verbs and hedging, where necessary).

Chemical and Mining Engineering task:

- Using information from all excerpts, write a paragraph of not more than 170 words (not less than 150 and not more than 190) discussing the main features of entropy.

- You will find the original task on Helios (mycourses), week 5, student tasks.

Entropy 1

- Entropy may be defined as a property according to which disorder in a system can be measured.[1] Nonetheless, although this definition has been used repeatedly over the past century, it may be flawed in a number of ways.[4] More specifically, there are cases when it might be difficult to differentiate an ordered from a disordered state and, on some occasions, we can detect an increase in the disorder but no change in the amount of entropy.[4] Furthermore, entropy is directly related to the Second Law of thermodynamics which states that entropy is responsible for a status change in matter and energy of an isolated system and, as a result, it is equal to or greater than zero.[1,2] Entropy change equal to zero can be observed only to a reversible process, whereas in an irreversible process entropy tends to increase.[2] The Carnot engine can be considered as an example of a reversible process, during which changes occur between a cold and a hot tank.[3] On the other hand, an example of an irreversible process during which heat is converted to work, is the engine cycle.[2]

Content

- Good intro sentence with an appropriate simple definition.

- Good order of information: outlining the problem of defining entropy on the basis of order/disorder and the need for quantifying it precisely. Then, reference to the 2^{nd} law and the Carnot engine as an example of a reversible process.

- Good choice of relevant ideas/points from the original texts.

Plagiarism / Language

- Appropriate use of citations.
- Use of material from all sources.
- Good use of paraphrasing, thus avoiding plagiarism:
  - Original: "The interpretation of entropy as disorder has prevailed in the literature over the past century. However, there are two difficulties with this interpretation. ".
  - Student: "Nonetheless, although this definition has been used repeatedly over the years, it may be flawed in a number of ways".
- Academically appropriate language devices:
  - Examples: 'may be defined as', 'it might be difficult to differentiate', 'nonetheless'.

Entropy 2

- Entropy has been defined as a thermodynamic property which is the measure of disorder.[2] It must be noted that for over a century it has been prevalent to interpret entropy in terms of disorder.[4] However, the following problems arise from this interpretation. Firstly, what constitutes 'order' is not precise in many cases and, secondly, an increase in disorder does not always result in an increase in entropy.[4]
- It is important to note that when matter and energy become disordered, entropy increases.[2] A combination of the above two remarks into a single statement is found in the second law of Thermodynamics.[2] The latter states that the entropy of an isolated system never decreases, and the total entropy change is zero if the entire process is reversible.[1] For instance, in the Carnot cycle, while the heat flow from the hot tank to the cold tank, isothermally, causes an increase in entropy, the work output, represents a decrease in entropy that could be used to operate the heat engine in reverse and return to the original state, thus the total entropy change is still zero at all times if the entire process is reversible.[3]

Overall

- A good example of a coherent text:
  - Appropriate structure: the definitions of entropy, the 2nd law, heat engines.
  - The student has used her/his own words, thus avoiding plagiarism.
  - Good use of citations.

- Information from all sources has been used.
- Academic language devices:
  - 'there may be a number of', 'it is important to note', 'often interpreted as', 'is of crucial importance'.

Summarising

- An appropriate summary of the original.
- Original:
  - However, there are two difficulties with this interpretation. First, the concept of order is not well-defined, and in many processes it is difficult, if not impossible, to decide which of the two states of the system is more or less ordered. Some specific examples are provided in refs 4 and 6. Note however that the term disorder here is used in its colloquial sense. There are some specific systems for which an "order parameter" may be defined, but this is not the type of order discussed in describing entropy. Second, there are cases in which an increase in disorder is clearly observed, yet the entropy change can be either zero or negative, therefore, invalidating the interpretation of entropy in terms of order and disorder. In spite of these difficulties, the order-disorder interpretation still lingers in the literature (4, p. 594).
- Student:
  - However, the following problems arise from this interpretation. Firstly, what constitutes 'order' is not precise in many cases and, secondly, an increase in disorder does not always result in an increase in entropy.[4]

Entropy 3

- Many people don't know about the term entropy, even though its meaning has existed for over 100 years in literature books. Entropy describes the second law of thermodynamics, because it is a phenomenon about the tendency of a system (1). If the system is isolated, the entropy boosts in a constant temperature and the increasing difference is defined by the following type: $\Delta S = T/qrev$ (2). In other words, the change in entropy is the heat divided by the temperature where the energy's transfer takes place (2). For example, reversible engine performing with two heat reservoirs (hot and cold) operates as a Carnot engine and all the heat absorbed is at the temperature of the hot reservoir and commonly all the heat rejected is at the temperature of the cold reservoir (3). However, the entropy for a reversible system is zero, because reversible systems are in equilibrium (no longer spontaneous processes) (1,4). Certainly, the order and disorder meaning of entropy is rejected (4).

Content

- Student:
  - Many people don't know about the term entropy, even though its meaning has existed for over 100 years in the literature books.
  - Nowhere in the original texts is it stated that people are not aware of entropy even though it is discussed in scientific literature. → a misinterpretation of the original.
  - 'in literature books' → books about literature = WRONG in this content.
  - 'in the relevant literature → sources (textbooks, research papers, reports, etc.) that relate to a field / research topic.

Content

- This sentence is incomprehensible:
  - Entropy describes the second law of thermodynamics, because it is a phenomenon about the tendency of a system.

  - Entropy does not describe the 2nd law: entropy may be explained using the 2nd law.
  - What is the meaning of the second clause? the tendency to what exactly? → Incomplete sentence

  .

Paraphrasing: misunderstanding the original

- An inappropriate paraphrase of the original.
- Original:
  - The interpretation of entropy as disorder has prevailed in the literature for over 100 years… However, there are two difficulties with this interpretation.
- Student:
  - Certainly, the order and disorder meaning of entropy is rejected (4).
    - Stating that an idea is rejected and mentioning the source is not enough. You need to discuss the reasons why this is so!
    - The original text refers to problems with this interpretation and mentions that, despite these problems, it is still used in scientific texts.

Entropy 4

The Second Law of Thermodynamics says that a system has a tendency to change spontaneously due to entropy. More specifically, it is equal to zero in reversible and positive in irreversible processes, thus, leading any operating engine to lose its power (1). It occurs since entropy as a measure of disorder has the tendency to be increased in any system isolated from its surroundings. Therefore, there is a great need in quantifying this definition as follows: the entropic change is proportional to the reversible, absorbed heat and counter-proportional to the constant of temperature, at which this absorption is accomplished (2). According to this quantitative approach it has been proved that the function of a reversible, thermal engine that is based on a simple thermodynamic cycle is non-achievable in practice on account of heat exchange (3). Despite the fact that entropy is considered as the measure of disorder, in some experiments a " decrease" in entropy has been observed because of ill-defined terms of "order" and "disorder" (4).

Paraphrasing

- The following is the same as the original; it is, therefore, unacceptable.

- Original:
  - The second law of thermodynamics is a statement about the tendency of a system to change spontaneously because of entropy.
- Student's paraphrase:
  - The Second Law of Thermodynamics says that a system has a tendency to change spontaneously due to entropy.
    - 'Says' is a verb used in popular texts; 'states' would be a more suitable choice.

Paraphrasing: misunderstanding the original

- Original:
  - Second, there are cases in which an increase in disorder is clearly observed, yet the entropy change can be either zero or negative, therefore, invalidating the interpretation of entropy in terms of order and disorder. (4, p. 594).
- Student's paraphrase:
  - Despite the fact that entropy is considered as a measure of disorder, in some experiments a " decrease" in entropy has been observed because of ill-defined terms of "order" and "disorder"
  - The original text does not mention experiments; the word 'cases' is used, which is not the same thing.
  - The original idea is not that a decrease in entropy, in some cases, is due to an erroneous definition of entropy.
    - On the contrary, the author argues that those cases invalidate the interpretation of entropy as order/disorder.

Electrical and Computer Engineering task:

- Using information from all excerpts, write a paragraph of not more than 170 words (not less than 150 and not more than 190) discussing the properties and types of semiconductors.

- You will find the original task on Helios (mycourses), week 5, student tasks.

Semiconductors 1

- Based on their electrical conductivity, all materials can be divided into metals, insulators and semiconductors. Metals are known for their high electrical conductivity, opaqueness and malleability and contain a large amount of free electrons [2]. On the contrary, insulators, whose valence band and conduction band are separated by a huge energy gap, do not possess any of them [1]. In semiconductors, electrical conductivity is neither as high as that of metals, nor as low as that of insulators [1].
- Semiconductors are grouped into intrinsic and extrinsic [3]. More specifically, an intrinsic semiconductor has zero free electrons at temperature zero [4], but that number grows exponentially as more heat is provided [3, 4]. In extrinsic semiconductors, higher conductivity cannot be achieved via temperature change, therefore doping is a good alternative. [3] Doping refers to the introduction of a relatively small amount of dopant impurities to a semiconductor and results in an increased number of electrons in its conduction band [1, 3, 4]. The dopant impurities are highly effective even at the tiniest of concentrations and are frequently used to produce semiconductors with specific properties, thus contributing greatly to the development of the electronics industry [4].

Overall

- Good structure:
  - Information is presented in a logical manner: types of materials and their properties, types of semiconductors, doping and its importance in the electronics industry.
- Good choice of information from all sources.
- Appropriate use of citations.
- Academically appropriate language devices:
  - Examples: 'can be divided into', 'are grouped into', 'more specifically'.

Paraphrasing

- Original:
  - "The impurities are employed to give semiconductors interesting and variable electrical transport properties, with which the electronics industry has developed and grown for over four decades".

- Good paraphrase of the original:
  - "The dopant impurities are … frequently used to produce semiconductors with specific properties, thus contributing greatly to the development of the electronics industry".

Semiconductors 2

- Semiconductors constitute a class of materials whose electrical conductivity is higher than that of an insulator but lower than that of a metal [1]. Electrical conductivity is a key feature in metals and one way to increase it vastly in semiconductors is by heating the material [2,3]. When an electron is given enough energy through heat, it passes from the valence band to the conduction band and acts as a charge carrier while simultaneously this placement creates holes representing positive charge that other electrons can relocate thus enhancing conduction. This type of semiconductor is known as a pure or intrinsic semiconductor [4]. The other type is called extrinsic semiconductor and is further distinguished in n-type or p-type. Their difference lies in the process of making them via a method called doping [1,4]. Doping adds an insignificant portion of those elements in a pure semiconductor, thus resulting in a significant increase of the electrical conductivity of the material [3]. This has greatly enhanced the properties of semiconductors and has, thus, had a considerable impact in the world of electronics [2].

Overall

- Good structure:
  - Information is presented in a logical manner: definition of semiconductors, types of semiconductors, doping and its importance in the electronics industry.

- Good choice of information from all sources.
- Appropriate use of citations.

- Academically appropriate language devices:
  - Examples: 'a key feature', 'is further distinguished into', had greatly enhanced', 'considerable impact'.

Semiconductors 3

- Metals are nonconductors of electricity. They can be easily shaped, and they are also opaque. If you examine the metallic crystal as a lattice of positive ions surrounded by electrons, then you can become aware of these properties of metals [1]. Currently in electronics we are able to analyze and use impurities with semiconductors to change their electrical transport properties [2]. There are two types of semiconductors, n-type and p-type. Each one of these is created through their matching with certain types of impurities, increasing their conductivity. The n-type presents electrons that can lead to conduction of electricity and create positive holes into which electrons can move. P-type means that the numbers of electrons in the conduction band is increased and enhanced (3,4).

Plagiarism / Content

- The student has plagiarised extensively (look at sentences highlighted in red):
  - Original: "A very simple model in which the metallic crystal is viewed as a lattice of positive ions surrounded by a 'gas' of free electrons provides a crude understanding of the first and third properties"
  - Student: "If you examine the metallic crystal as a lattice of positive ions surrounded by electrons, then you can become aware of these properties of metals".
    - The final text is therefore unacceptable.
- Content (in blue):
  - Choice of material from the original: The main difference between intrinsic / extrinsic semiconductors is not discussed.
  - Although the use of impurities is mentioned, their use in extrinsic semiconductors is not mentioned.

Semiconductors 4

- Semiconductors were considered independently by Braun (1874) and by Schuster (1874). Braun had been occupied with experiments in which a crystal such as ferrous sulfide was contacted with a very thin wire, and the resistance arose from the function of the direction in which current was flowing [2]. Semiconductor materials, such as silicon or germanium, are intermediate materials between insulators and conductors as far as electrical conductivity is concerned [3]. Electrons present in the upper conduction band help the semiconductor being able to conduct electricity. Also, the removal of electrons from the lower valence band creates positive holes into which electrons can move, again leading to the ability to conduct charge [4]. Metals have large electrical conductivity and that's why some of the electrons can move freely through the bulk of them [1]. In each element , an atom provides four valence orbitals and four valence electrons, and, in the bulk element, this leads to the formation of a fully occupied band and an unoccupied band lying at higher energy.[4]

Content

- There's no reference to the classes of semiconductors, which is essential in this text.
- Instead, the student has used unnecessary information, e.g. reference to the research by Braun (1874) and Schuster (1874).
- It's not appropriate to use examples in the simple definition. You can use them after discussing main characteristics:
  - "Semiconductor materials, such as silicon or germanium, are intermediate materials between insulators and conductors as far as electrical conductivity is concerned".

Plagiarism

- The student has plagiarised in that s/he has not changed the original text although s/he has cited the source:
- Original:
  - Additionally, the removal of electrons from the lower valence band creates positive holes into which electrons can move, again leading to the ability to conduct charge.
- Student:
  - Also, the removal of electrons from the lower valence band creates positive holes into which electrons can move, again leading to the ability to conduct charge [4].
- Original:
  - From the large electrical conductivity of metals, it appears that at least some of the electrons can move freely through the bulk of the metal
- Student:
  - Metals have large electrical conductivity and that's why some of the electrons can move freely through the bulk of them

Mechanical Engineering task:

- **Using information from all excerpts, write a paragraph of not more than 170 words (not less than 150 and not more than 190) discussing the most important features of conduction and convection.**

- **You will find the original task on Helios (mycourses), week 5, student tasks.**

Conduction and Convection 1

- Energy transfer is comprised of two main mechanisms, convection and conduction. Conduction can be described as the process, in which a particle with higher energy transfers an amount to another particle with lesser energy [1]. It is well documented that having a higher temperature is linked to a higher molecular energy [1]. Particles in the same space will always clash with each other, due to their random motion, leading to energy continually flowing from the particle with higher energy to the one with lower [1]. However, convection heat transfer also happens from the movement of the fluid, aside from energy transfer from random molecular motion [1]. We describe the convection as forced in the instance of the flow being created by outside interference or as free when it is created by natural laws [1].
- According to Cengel [3] the laws of heat transfer are routinely encountered in the human body and are the basis for the function of many household apparatuses. Nonetheless, the topic of how conduction and convection interact has not been extensively examined and only two relevant studies have investigated it, namely, Sidorov and Kadansoff [4]. Thus, this constitutes an interesting area for further research.

Overall

- Good structure:
  - Information is presented in a logical manner: the types of heat transfer, the types of convection, examples of heat transfer.
- Good choice of information from all sources.
- Appropriate use of citations.
- Academically appropriate language devices:
  - Examples: 'can be defined', 'it is well documented', 'according to Cengel', 'nonetheless'.

Summarising

- Original:
  - Heat transfer is commonly encountered in engineering systems and other aspects of life, and one does not need to go very far to see some application areas of heat transfer. Many ordinary household appliances are designed, in whole or in part, by using the principles of heat transfer.... Of course, energy-efficient homes are designed on the basis of minimizing heat loss in winter and heat gain in summer. Heat transfer plays a major role in the design of many other devices, such as car radiators, solar collectors, various components of power plants, and even spacecraft. The optimal insulation thickness in the walls and roofs of the houses, on hot water or steam pipes, or on water heaters is again determined on the basis of a heat transfer analysis with economic consideration [2].
- Good summary of the original:
  - According to Cengel [3] the laws of heat transfer are routinely encountered in the human body and are the basis for the function of many household apparatuses.

Summarising

- Good summary of the original:
  - "Nonetheless, the topic of how conduction and convection interact has not been extensively examined and only two relevant studies have investigated it, namely, Sidorov and Kadanoff [4]. Thus, this constitutes an interesting area for further research".
  - The last sentence suggesting areas for further research or highlighting that this is an interesting research avenue is an important feature of research writing and forms an integral part of a research paper.

- Original: (see next slide).

Summarising

- Original:
  - The interaction of conduction and convection is a relatively poorly explored subject, and no references dealing with the problem treated in this paper were found during the search of the literature. Two related studies, however, should be mentioned. Sidorov [l], by assuming that the fluid has everywhere the temperature of the outer boundary of the thermal boundary layer, estimated the contribution of radiation and then solved the energy equation for flow of a radiating fluid along a flat plate in a very approximate manner. Kadanoff [2] treats the transport of energy in an ablating body which absorbs, emits, and scatters thermal radiation. He used the integrated form of the equation of transfer, known as the Milne-Eddington approximation, to simplify the energy equation. A book by Konakov, et al. [3] reviews radiant heat-transfer studies related to furnaces and combustion chambers. [3, p. 318]

Conduction and Convection 2

- The term *conduction* is entangled with the concepts of molecules , particle motion and collisions, because they describe one of the two main mechanisms of heat transfer in both solids and fluids.[1] Therefore the chaotic movement of more energetic molecules in a region of the examined domain, is transferred to less energetic ones through collisions, lowering the *total* energy of the highly energetic region and increasing the energy of the less energetic one, which explains why heat is conducted along the directions of decreasing energy.[1]
- The second fundamental heat transfer mechanism found in non solid domains is *convection* which concerns the combination of the above principles with the macroscopic movement of *bulks* of molecules -fluid description. Convection may be categorized as forced or free depending on whether the flow is based on external means or buoyancy forces, respectively. [1] In general, heat transfer is essential in many applications, such as cooling and heating, to optimize them using energy/economical criteria, and also in the study of the human body.[2] However, research in the interaction of the mechanisms of conduction and convection is still in its infancy with papers by Sidorov and Kadansoff focusing on fluids, which is the only domain they can be equally present[3].

Overall

- Another good example of a coherent text using:
  - Information from all sources.
  - The student's own words together with acknowledgment of the original source.

- Good structure mentioning types of heat transfer, types of convection and relevant examples.

Summarising

- Student' summary:
  - In general, heat transfer is essential in many applications, such as cooling and heating, to optimize them using energy/economical criteria, and also in the study of the human body [2].

- Original: (see next slide)

Summarising

- Original:
  - The human body is constantly rejecting heat to its surroundings, and human comfort is closely tied to the rate of this heat rejection. We try to control this heat transfer rate by adjusting our clothing to the environmental conditions. Many ordinary household appliances are designed, in whole or in part, by using the principles of heat transfer. Some examples include the electric or gas range, the heating and air-conditioning system, the refrigerator and freezer, the water heater, the iron, and even the computer, the TV, and the VCR. Of course, energy-efficient homes are designed on the basis of minimizing heat loss in winter and heat gain in summer. Heat transfer plays a major role in the design of many other devices, such as car radiators, solar collectors, various components of power plants, and even spacecraft. The optimal insulation thickness in the walls and roofs of the houses, on hot water or steam pipes, or on water heaters is again determined on the basis of a heat transfer analysis with economic consideration.

Conduction and Convection 3

The text explains the conductivity of materials. How or not the transport increases in various cases. It first shows us the transfer of heat from body A to body B. Giving an example of how a silicate brick wall affects a specific thermal conductivity. Since the main factor for conductivity is initially the volume of the body's molecules but also their quantity. {1} [many unfinished sentences here]

Heat transfer is essentially energy transfer. In a fluid, for example, there is initially a large amount of molecules and they move collectively or as an aggregate many times. Such a move, especially in conjunction with a temperature, helps to transfer the temperature. Heat transfer can be either forced or free. {2}

To understand heat transfer, it is not necessary to go to a laboratory, it is done every day in our lives either by people to the environment and vice versa. Noticing that in winter we wear "thick" clothes to keep warm as much as possible. Therefore, it is concluded that with a larger surface area, the conductivity index decreases. {3} We do not know how conduction and convection interact, since there are not many reports, but we have seen results several times. {4}

Content

- Paraphrasing and summarizing do NOT mean stating the possible function of the original text ("the text explains").
  - When used, it shows a misunderstanding of how to incorporate original material in a coherent text or how to make reference to the work of other writers in the academic context (look at al the phrases in blue in the 1st paragraph in the previous slide).

- This practice is reminiscent of summarising tasks that are usually done at secondary level, where the aim is to evaluate a student's understanding of the function of an original text.
  - At tertiary level, using information from various sources is done, amongst others, to support an argument or to show that we understand current research.
    - Therefore, this 'different' aim needs to be reflected in language by using devices such as research verbs, citations, etc.

Content

- The student makes reference to the types of convention without explaining them.
  - Student: "Heat transfer can be either forced or free".

- Again, including information from the original that you think is useful without explaining why you've done so means that your aim is simply to MENTION it and not to write a coherent text.
  - It is one thing to say: the author has categorised convection into two types → secondary level.
  - And it is another thing to say: convection is categorised into types (and them move on to explaining them) → tertiary level.

Summarising

- Student:
- We do not know how conduction and convection interact, since there are not many reports, but we have seen results several times. {4}

- Original:
- The interaction of conduction and convection is a relatively poorly explored subject, and no references dealing with the problem treated in this paper were found during the search of the literature. Two related studies, however, should be mentioned. Sidorov [l], by assuming that the fluid has everywhere the temperature of the outer boundary of the thermal boundary layer, estimated the contribution of radiation and then solved the energy equation for flow of a radiating fluid along a flat plate in a very approximate manner. Kadanoff [2] treats the transport of energy in an ablating body which absorbs, emits, and scatters thermal radiation. He used the integrated form of the equation of transfer, known as the Milne-Eddington approximation, to simplify the energy equation. A book by Konakov, et al. [3] reviews radiant heat-transfer studies related to furnaces and combustion chambers. [3, p. 318]

Summarising

- Part of the student's summary [in red] in incomprehensible:
- We do not know how conduction and convection interact, since there are not many reports, but we have seen results several times. {4}

- Perhaps what is implied is that some studies on their interaction do exist, but it is not at all clear if this is the student's intended meaning.

Language

- Addressing the reader by using the personal pronoun 'we' is a distinguishing feature of popular and not academic genres.

- Extensive use of popular features and relatively informal language.
  - Examples: 'noticing that in winter we wear "thick" clothes to keep warm as much as possible', 'it is done every day in our lives'.

Conduction and Convection 4

- Heat transfer can be found in many systems of engineering, but also in our own bodies. We transmit warm, in order to stay comfort, by altering our clothing. There are plenty devices based on heat transfer, which are used in daily basis, such as freezer, iron and television. In addition, some important engineering appliances depend on heat transfer [1]. Despite the interaction of conduction and convention being ineffectively researched, there are a few expert's studies surrounding the subject. Sidorov's and Kadanoff's research, about energy equation, worth being mentioned[2]. Conduction is the energy transmission from high-energy to low-energy particles. Placing a gas with different temperature levels between two surfaces, will lead in movement of the molecules. When side to side particles collide, there is energy transfer, from higher to lower temperature levels (a metal spoon gets warm in a cup of coffee). Another mode of heat transferring is convection, accomplished by fluid motion, in different temperature levels. The superposition of energy transfer, is divided to the particle motion and referred as convection and the bulk fluid motion, as advection. There are two types of convection, forced and natural [3] .

Overall

- Information order is problematic:
  - The student begins by referring to examples and only at the end explains the two types of heat transfer.
  - Moreover, s/he refers to research in the interaction between the two mechanisms before introducing them.
  - The types of convection are mentioned at the end without explanation.

- When you modify a technical phrase, the meaning may not be exactly the same:
  - 'Heat transfer' and 'heat transferring' do not mean exactly the same thing.
  - You don't need to change technical terms/phrases.

Naval architecture task:

- Using information from all excerpts, write a paragraph of not more than 170 words (not less than 150 and not more than 190) discussing Froude's contribution to ship resistance.

- You will find the original task on Helios (mycourses), week 5, student tasks.

Ship Resistance and Propulsion 1

- In the mid-nineteenth century, an important problem faced by the scientific community concerned how to calculate the power required of ships to keep their speed constant [2]. Froude was the first to use model scale testing to calculate resistance forces [4]. Through experiments, he concluded that resistance depends on the ratio of velocity squared to hull length[1,2,4]. This ratio is known as the Froude number and it is dimensionless [1,2,4]. As this ratio increases, so does the resistance [4]. Moreover, according to the results of Froude's experiments, ships of different sizes but similar geometry hulls show the same waveform when they present the same Froude number [1,2]. Furthermore, Froude suggested that resistance consists of two parts: skin friction resistance and residuary resistance [2].
- What gave value to all of the above was the Law of Similitude as it provided a link between the results of the experiments and the full-sized vessels [4]. In sum, although Froude failed to accurately calculate the ship's propeller performance, he offered the scientific field the basic idea on which subsequent discoveries were based [3].

Content

- Good intro sentence outlining the problem at the time.
- Good order of information (from general [i.e. the main issue at the time]) to Froude's contribution and its importance.
- Good choice of scientifically relevant ideas/points from the original texts.

Plagiarism / Language

- Appropriate use of citations.
- Use of material from all sources.
- Good use of paraphrasing, thus avoiding plagiarism:
  - Original: "William Froude (1810–1879) was the first to champion and prove the validity of scale model testing in the design of ocean going vessels. "
  - Student: "Froude was the first to use model scale testing to calculate resistance forces".
- Academically appropriate language devices:
  - Examples: 'he concluded', 'Froude suggested', 'what gave value to the above', 'in sum'.

Ship Resistance and Propulsion 2

- Before the late 1860s, there was little knowledge and understanding of ship resistance in relation to waves and a vessel's size [1,2]. In 1870, using government funding, Froude conducted several experiments on model vessels in still water, leading him to a number of conclusions concerning the relationship between ship resistance and the vessel's shape and velocity [1]. The Froude number, a constant measuring resistance, is used until today, together with the "Law of Similitude", one of his most significant contributions in naval engineering. When applied, a model vessel can be used to determine a normal ship's actual properties. Due to this, it has been adopted globally and is used for all vessel types [4]. In addition, Froude also proposed a theory of propeller action that took into consideration the propeller's geometry, thus contributing to the whole resistance of the ship [3]. His towing research might not have been accepted from the beginning and some of his publishes may not have come into correspondence with actual propeller performance but Froude's general contribution to our knowledge of ship resistance cannot be questioned [2,3].

Overall

- Another good example of constructing an academic text using pertinent scientific information.
- The student has used information from all sources and has constructed her/his text around Froude's main contributions, that is, Froude's number and the Law of Similitude.
- Good use of paraphrasing/summarising/citations and academic language.

Summarising

- Original:
  - With this evidence he persuaded the government to fund the building in the early 1870s of a towing tank, almost 100m long, across the road from his house. With the assistance of his third son Robert Edmund, born in 1846, he was able to tow his models at a known speed through still water using a steam-powered winch that pulled the carriage along a track suspended over the tank (Fig. 2b). The drag force acting on the models was monitored by a custom-designed dynamometer [10].
  - What Froude observed was that large and small models of geometrically similar hulls produced different wave patterns when towed at the same speed (Fig. 2c). However, if the larger hull was pulled at greater speeds, there was a speed at which the wave patterns were nearly identical. This occurred when the ratio of the velocity squared to the hull length was the same for both large and small hulls. He had thus demonstrated that geometrically similar hulls would also be dynamically similar, in terms of wave resistance, when this ratio—now known as the Froude number—was constant. In his own words [6]: That "Law of Comparison" is that if the speeds of the ships are proportional to the square roots of their dimensions, their resistances at those speeds will be as the cubes of their dimensions.
- Student's summary:
  - In 1870, using government funding, Froude conducted several experiments on model vessels in still water, leading him to a number of conclusions concerning the relationship between ship resistance and the vessel's shape and velocity [1].

Ship Resistance and Propulsion 3

- Until about 1860, there was no deep knowledge of ship resistance [2]. Consequently, inadequate power was often installed on the ships [2]. A bit later, Froude, influenced by a costly failure of some shipbuilders of the time, started doing experiments, about ships' resistance [1]. William Froude (1810–1879) was a pioneer in this field and the proof of the validity of the scale model is due to him and so does the technique of the rolling of ships [4]. Without taking anything for granted, he was observing modeled ships and he drew his own conclusions [1]. Thus, he introduced the idea of divide the resistance into skin friction resistance and residuary resistance [2]. He started using beams of different dimensions and surfaces and by the 1890s, Taylor had established the use of perfect models for resistance tests [2]. Later, the exact impact of the waves on the ship was determined and ways were found to increase the resistance of the hull [2]. However, it should be noted that, despite his brilliant career, Froude made also few, but serious mistakes [3].

Content

- A descriptive and detailed historical account without any reference to Froude's contribution, that is, Froude's number and the Law of Similitude.

- This text would be fine in a popular genre or as part of an introductory textbook addressed to undergraduates students.
  - It is unsuitable as a standalone paragraph aiming to put into practice the conventions of academic writing.

- The student has not used information from all sources.

Ship Resistance and Propulsion 4

- Froude partly participated in engineering the Great Eastern whose design had important financial effects. After that he decided to ask the government's aid for an experiment of his own in order to understand the source of that problem. With the use of a towing tank he noticed that irrespective of the size of the hulls or the ships, when the hulls were geometrically similar and the wave resistance had a constant ratio, the hulls were also dynamically similar. [1] Froude conducted research in which he discovered that the wave resistance and the geometrically similar forms were alike in relation to the speed and the model length.[2]

Content

- Another descriptive and detailed historical account without any reference to Froude's contribution.
  - This text would be fine in a popular genre or as part of an introductory textbook addressed to undergraduates students.
- The student has not used information from all sources.
- Relatively short: the final text is 109 words while the required text was supposed to be from 150 to 170 words.

Content / Language

- The last sentences are repetitive:
  - They could have been condensed to shorter and more informative sentences.
  - Since the student is actually describing Froude's number, s/he should also mention it explicitly.

  - "With the use of a towing tank he noticed that irrespective of the size of the hulls or the ships, when the hulls were geometrically similar and the wave resistance had a constant ratio, the hulls were also dynamically similar. [1] Froude conducted research in which he discovered that the wave resistance and the geometrically similar forms were alike in relation to the speed and the model length.[2]"

Ship Resistance and Propulsion 5

Froude's research was impacted by the flawed design of the enormous iron-clad ocean liner Great Eastern , the largest ship in the world at the time[1],[2]. Despite the inclusion of paddle wheels and a screw propeller, as well as auxiliary sails the size of the ship made it so it lacked power , thus it could not pay for the cost of its fuel[1]. Even though Froude's involvement the engineering of the ship was small , he clearly understood that engineers at that time had insufficient knowledge concerning wave resistance and the effects of size[1],[3]. So he started experimenting with two scale models on River Dart , leading him to proving that that there was no ideal form and that performance varied with speed[1]. Due to the success of this endeavor he managed to secure funding for a 100m long towing tank which he used to tow his models at known speeds so that he can measure the drag force acting on them[1]. With his research he found that geometrically similar hulls produced different wave patterns when towed at the same speed but as the speed of the larger hull increased so that the ratio of the velocity squared to the hull length(later named Froude number) was the same for both large and small hulls the wave patterns become nearly identical[1],[3].Introducing the Law of Comparison one of his greatest contributions to naval architecture became the basis of all model testing[1],[2] .Froude also proposed that total resistance could be divided into skin friction resistance and residuary, mainly wave-making, resistance[3]. He made estimates on frictional resistance after a series of calculations on planks of differing lengths and surface finishes[3] . Realising , additionally, that specific residuary resistance would not change on corresponding speeds between model and ship[3]. His suggestions were at first rebutted but they later amassed acceptance after full scale tests were executed and later became the basis on which modern theory was founded [3],[4].

Plagiarism

- The main problem with this text is that it has been plagiarised to a very large extent (all the sentences in red).
  - Therefore, it is completely unacceptable.