A! Appendix 1

1.1 Getting the Tense Right

Both the **introduction** *sections* of research papers, as well as the **introduction** and **literature review/theory** *chapters* of a master's thesis, can choose from **three tenses** when describing their research area: the ***present***, ***past*** and ***present perfect*** tenses. These three tenses enable writers in engineering and science to clearly indicate a shift in perspective as they move from **(1)** introducing a new topic to **(2)** describing the work of previous studies and then **(3)** providing the writer's own comments on these studies. Let's now examine how these three tenses are typically used in introductions.

Please note that the rules listed here cover the use of ***simple form*** of these tenses (e.g., *'presents'*). Avoid using continuous forms, such as *'**is** present**ing**', '**was** present**ing**', or '**has been** present**ing**'.*

Present Tense

The present tense can be used for a variety of purposes in research Introductions:

A. Use the present tense in ***definitions***, ***descriptions***, statements of ***general, accepted knowledge***, or for making ***generalizations*** or ***claims***.

> Lignins `are` aromatic polymers synthesized mainly from three phenolic monomers, called monolignols, at proportions varying between plant species.
>
> Common symptoms of severe distortion `include` nuisance tripping of industrial processes and medical equipment, excessive heating in transformers, and equipment failure.

B. In most fields of engineering, the present tense is used to report the ***work of a single study***. For reporting the work of *multiple* authors, use the present perfect tense.

> **In [14], the authors** `report` the sliding-mode control of a linearized plant models and numerical simulations.
>
> **In [1],** a directed diffusion approach `is proposed` for forwarding data in sensor networks.

C. Describe ***mathematical proofs*** and ***chemical formulas*** using the present tense, since going through the proof occurs at the time of reading.

> From Equation 1, we `derive` the following system of inequalities.

D. Use the present tense as a *'timeless' tense* to describe information in your own work that does not change over time, such as the *aim/purpose* of your study, references to *tables and figures*, and descriptions of *chapters and sections*.

> **The aim of this study is to** evaluate the relative energy savings of various control strategies.
>
> **Figure 1 shows** the structure of the SPE device.
>
> **Section 2 presents** an overview of the K-means algorithm.

E. Use the simple present tense to *evaluate* or *comment* on the work of previous studies.

> **However**, these technologies **suffer** from limited accuracy or a lack of infrastructure.
>
> RFID **requires** a large number of infrastructures to accurately determine the location.

Present Perfect tense

Use the present perfect to introduce *research activities* or *processes* as a new topic that will be continued in the following sentences. Table 3 lists the research activities most commonly used as the subjects for topic sentences in engineering fields. Sentences using the present perfect typically announce *recent research or trends* reported from *multiple studies*.

> **Various methods have been used to** construct models for resistive antennas.
>
> **Several approaches have been proposed for** overcoming these problems **[5],[6],[8].**
>
> **Numerous algorithms have been developed for the** detection of ECG beats **[4]-[8].**
>
> **Many studies have focused on** analyzing customer's mobile device usage **[10]-[15]**.
>
> **Much research has been directed towards** feature recognition in human faces **(See [7] for a review)**.

The following **research activities** are typically used in **subject** position with a verb in the present perfect. These sentences function as topic sentences and use sentence **strategies 5-7** listed on the preceding pages.

Algorithm	Formula	**Method**	Scenario	**Solution**
Approach	Framework	Metric	**Strategy**	**Technique**
Architecture	Heuristic	Model	Structure	Technology
Design	Materials	Procedure	System	Theory
Equation	Mechanism	Process	**Scheme**	Tool
Extension	Measure	Protocol		

Table 3 Superordinate terms commonly introduced as **research activities** using the *present perfect*.

Past tense

In most academic fields, the past tense is the most preferred tense for reporting the earlier **work of a single study**. However, though also possible in engineering, it is less commonly used for this purpose, instead the *present tense* is preferred.

> **In [19], a <u>method</u> was proposed** to achieve perfect secrecy by randomizing transmission coefficients.
>
> **Young et al. (2005) applied** a high-performance internal computer and flat panel display technology to the vehicle meter system to increase the vehicle's computing capacity

1.2 Tense Shift

Figures 1-3 present examples that use a **tense shift** (i.e., changes in tense) to distinguish between three types of information:

  a. the topic sentence introducing the work of *multiple research groups*,
  b. the work of a *single research group*, and
  c. the voice of *you*—the thesis writer.

(1) Present perfect – Past – Present

As shown in Fig. 1, the **present perfect** is used to introduce a "line" of research methods as a new topic. In Figure 1, **sentence 1** acts as an overall **topic sentence** to introduce a new focus on "methods" as the topic that will be discussed as **given information** in the following sentences, while **sentences 4 and 5** introduce a number of other methods. Note that the **subjects** of all three sentences refer to **research activities**.

> [1]**Several other <u>methods</u> have** also **been** applied to merged measurement tracking. [2]**An <u>approach</u>** based on Multiple Hypothesis Tracking (MHT) **was** proposed **in [5],** which used a two-target resolution model to maintain tracks in the presence of merged measurements. [3]**A similar resolution <u>model</u> was** applied to Multiple Model JPDA **in [6], [7],** which **is** again limited to a maximum of two merged targets. [4]**Various numerical data association <u>techniques</u> have been** developed for merged measurements **in [8], [9]** (Probabilistic Data Association), and **[10]** (Markov Chain Monte Carlo). [5]In addition, Probabilistic MHT (PMHT) **[11],** and existence-based methods, such as Linear Multi-target Integrated PDA (LM-IPDA) **[12],** and Integrated Track Splitting (ITS) **[13] have** also **been** applied to this problem. [6]**These are** all useful techniques; **however,** with the exception of LM-IPDA (which trades off performance for reduced complexity), they only handle a small number of targets.

Figure 1 Tense shift of *Present perfect-Past-Present* using **information-prominent** reporting style (Elec. eng.)

Since the sentences following the topic sentence (i.e., **sentences 2-3**) typically describe what individual authors/research teams **"did"**, it is not surprising that they use the *past tense*. Finally, in **sentences 3 and 6**, the writer evaluates and comments on the work of these individual authors using the *present* tense to clearly indicate that these are writer's ideas, and not those of the cited researchers.

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[1]Market-based **mechanisms** for sensor management **have** started **to gain attention** only recently **[22]–[24]**. [2]**In [22], the authors** explored the possibility of using economic concepts for sensor management without explicitly formulating a specific problem. [3]**The authors in [23]** used the concept of Walrasian equilibrium **[25]** to model market-based sensor management. [4]**In [24], the authors** also proposed a Walrasian equilibrium-based dynamic bit allocation scheme for target tracking in energy- constrained wireless sensor networks (WSNs) using quantized data. [5]**However, as shown in [26],** Walrasian markets can be unstable and can fail to converge to the equilibrium. [6]**Moreover,** computing the equilibrium prices and allocations can be computationally prohibitive. [7]**Accordingly, the authors ([23] and references therein)** proposed algorithms to compute an approximate equilibrium. [8]**However, the mechanisms** proposed **in [23], [24]** are not truthful and are, therefore, prone to market manipulations.

Figure 2 Tense shift of *Present perfect-Past-Present* using **author-prominent** reporting style (Elec. eng.)

In Figure 2, note that after the topic sentence, each following sentence uses **"the authors"** (**2-4** & **7**) as the **subject** or a **citation** (**5**) to introduce the **mechanisms** used by individual authors, and the present tense to critically evaluate their work.

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[10]Sludge characteristics **are** important when operating reactors to achieve a certain capacity. [11]Generally, granules with inferior settling ability are easier to be washed out. [12]Therefore, the floatation of anammox granules **has been** investigated **(Chen et al., 2010; Dapena-Mora et al., 2004; Trigo et al., 2006)** because floatation leads to granule washout and eventually deteriorates the capacity of the reactor. [13]**Chen et al. (2010) found that** floatation **could** cause instability and collapse of the anammox reactor. [14]Moreover, gas pockets **were found** inside the floating granules (FG). [15]These floating granules **were** washed out when the hollows **became** filled with gas bubbles. [16]The hollows inside the granules resulted from cellular lysis and the gaps formed during the aggregation of small granules. [17]**Trigo et al. (2006)** claimed **that** the addition of Ca^{2+} in the influent **could** improve the granule density but would reduce the ratio of volatile suspended solid (VSS) to suspended solid (SS) and the NRR. [18]However, the key factors that **cause** floatation in high-rate anammox systems **remain** unclear.

Figure 3 Tense shift of *Present perfect-Past-Present* using **author-prominent** reporting style (Elec. eng.)

Similar to the text in Figure 2, texts in chemical engineering (Fig. 3) tend to use an **author-prominent** reporting strategy, as well as the *present perfect* (**sentence 12**) to introduce a new research activity, and the *past tense* (**sentences 13-17**) to report the results of individual studies. The *present tense* is used in **sentence 10** to signal the writer's comment about the importance of the topic, **sentence 11** to make a generalization, and **sentence 17** to evaluate (criticize) the claim made in the study described in the previous sentence.

(2) <mark>Present perfect</mark> – <mark>Present</mark> - <mark>Present</mark>

As we have already seen, although the *past tense* can be used in engineering fields, the **present tense** is more typically used to report single, individual studies. In Figure 4, the research activity **algorithms** is first introduced as a topic sentence (**sentence 16**) in the **present perfect**. Thereafter, all references to earlier studies (**sentences 20, 22-23**) as well as comments on these studies (**sentences 17-19, 21-22, 24**) are reported using the **present tense**.

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[16]**Many clustering algorithms** in various contexts <mark>**have been** proposed</mark> **[2]–[3], [5]-[7], [23]–[28]**. [17]**These algorithms** <mark>**are**</mark> mostly heuristic in nature and aim at generating the minimum number of clusters such that any node in any cluster <mark>**is**</mark> at most d hops away from the clusterhead. [18]**Most of these algorithms** <mark>**have**</mark> a time complexity of O(n) where n <mark>**is**</mark> the total number of nodes. [19]**Many of them** also <mark>**demand**</mark> time synchronization among the nodes, which <mark>**makes**</mark> them suitable only for networks with a small number of sensors. [20]**The Max-Min d-Cluster Algorithm [5]** <mark>**generates**</mark> d-hop clusters with a run-time of O(d) rounds. [21]However, **this algorithm** <mark>**does** not **ensure**</mark> **that** the energy used in communicating information to the information center <mark>**is minimized**</mark>. [22]**The clustering algorithm** proposed **in [7]** <mark>aims</mark> at maximizing the network lifetime, but <mark>**it assumes**</mark> **that** each node is aware of the whole network topology, which <mark>**is**</mark> usually impossible for wireless sensor networks which <mark>**have**</mark> a large number of nodes. [23]**Many of these clustering algorithms [23], [26]-[28]** <mark>**are** specifically **designed**</mark> with the objective of generating stable clusters in environments with mobile nodes. [24]However, in a typical wireless sensor network, the sensors' locations <mark>**are fixed**</mark> and the instability of clusters due to mobility of sensors <mark>**is**</mark> not an issue.

Figure 4 Tense shift of *Present perfect-Present-Present* using **information-prominent** reporting style (Elec. eng.)

Note how important it is that all the sentences are linked through a single topic **algorithms**. This is important, since the text lacks the typical *past-present* tense shift. As already mentioned earlier, the **present tense** is used to express **established facts**. Does this then mean that engineers view earlier studies as being facts, not to be challenged or questioned?

Figure 5 presents an extract from an engineering article introduction that uses an **author-prominent** strategy to report and link the ideas of other researchers. Once again the first sentence (**12**) appears to be a topic sentence, since it uses the present perfect. However, it is not effective as a topic sentence, since it only makes a claim about the amount of effort, not about the content of the following sentences. Would **sentence 13** make a better topic sentence? Is a "metric" the same thing as a "technique" (**14**) or a comparison (**15**)?

[12]**There has been** considerable **work** reported on detecting scene changes based on entire images. [13]Difference metrics **are used to** evaluate the changes between successive frames, and global thresholds **are used** to determine whether changes have taken place. [14]**Nagasaka and Tanaka [3] experiment** with various comparison techniques, including difference of gray-level sums, sum of gray-level differences, difference of gray-level histograms, colored template matching, difference of color histograms and x2 comparison of color histograms. [15]Such comparisons **are** only **applied to** a portion of each image. [16]**They conclude that** the most robust methods is the xz comparison of color histograms. [17]To guard against momentary noises like camera flashes, **they** further **divide** each frame into 4x 4 rectangular regions of equal size and **compare** every pair of regions. [18]The largest differences **are discarded**, and the detection **is done** on the remaining ones. [19]**Their** method **is** robust against zooming and panning, but **may fail** to detect special effects such as fading. [20]**Otsuji et al. [4] use** brightness data to compute both the frame-based histogram and pixel-base inter-frame difference. [21]A cut break **is defined** as a seamed point between different moving pictures. [22]Continuous transitions **are** not **considered**. [23]**In a later paper, Otsuji and Tonomura [5] propose** a projection detection filter for more reliable video cut detection.

Figure 5 Tense shift of *Present perfect-Present-Present* using author-prominent reporting style (Elec. eng.)