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Helpful for experienced and new authors, the purpose of this paper is to provide guidance for the preparation of an SAE International technical paper. Guidance on each technical paper element has been placed in the appropriate section as much as possible.

A technical paper is a fact-based document used to close a project or a piece of work. Papers are written in an objective, formal, impersonal, third-person style (not using "I" statements, with no commercialism.

SAE International does not restrict the number of pages for a technical paper, although the recommended length is 9-12 pages in a 2-column format. This template is not required and is simply a guide, but it is strongly recommended that it be used; however, please make sure an Abstract and Keywords are included in the manuscript.

Guidelines for submitting a Revised Manuscript are provided at the end of this document.

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Abstract

The abstract is what readers look at first to decide whether the paper is relevant to their work and whether they should read the paper for their own research work; therefore, it is critical to provide necessary information in the abstract. The abstract should provide clear and concise statements on the contents of the paper. It should contain information on what the work is about; how the work is different from other previously published, related work; a brief discussion on the novelty of the work; the methodology that has been followed; and the theory that has been used to complete the work. The abstract is a self-standing portion and should *not* include references, footnotes, or figures and tables (or references to them). It should include brief findings, solutions, impacts, and concluding remarks of the work. The abstract should be one paragraph, with 250-300 words. Symbols, special characters, abbreviations, footnotes, and math should not be used in the abstract.

Keywords

Keywords are essential to make your paper discoverable through search engines. Include 5-8 appropriate keywords to precisely reflect the research content and scope.

Introduction

The purpose of this document is to help the author write an SAE technical paper. The paper, in this case, will be a peer-reviewed paper and will most likely be presented at a conference. Although the depth of your research done, actual work done, and the findings of the work could be different (based on conference or journal papers), there are certain consistencies that need to be maintained in writing a technical paper, and this is what is emphasized in this document. The highest quality event papers will be considered for publication in the *SAE International Journal of Advances and Current Practices in Mobility.*

This document concerns content and suggestions for improvement of your work only. Formatting instructions can be found in the Style Guide on the author resources page of the SAE website: http://volunteers.sae.org/authors/styleguide.pdf. Note: The final formatted, published paper may not look like the final author-formatted submitted paper.

Prior to writing the technical paper, it is recommended that the author prepare an outline following the guidelines mentioned in this document. This will help to express thoughts in a systematic manner.

The Introduction of the paper is very important and serves three purposes:

1. It discusses the importance and motivation behind the work. The Introduction must indicate why the

work presented in the paper is significant, and it should introduce the reader to the paper's objective, motivation, and scope.
2. The Introduction states how the paper adds to the existing knowledge of similar work that has been done. This should be discussed further by acknowledging and citing references of the papers obtained from a literature review, so that the reader can learn more about what has been done so far in this area. All claims, statements of fact, or new data/information must be supported by references. Authors may choose to provide a literature review section that appears immediately after the Introduction (see next section).
3. The Introduction must give an outline of the paper that helps the reader understand what to expect in the remainder of the paper.

Each of these three areas can be addressed by separate subsections within the Introduction.

The Introduction should be concluded with a summary description of the paper's upcoming sections. The paper should have a smooth flow of content, telling a succinct story of the research work that has been completed. The conclusion of the Introduction should clearly identify for the reader the paper's purpose and highlight discussions that will be covered in the remainder of the paper.

Literature Review and References

All claims, statements of fact, or new data/information must be supported by references. Referring to other researchers' work on the same or similar topic authenticates the current work and allows an author to acknowledge the related work of other researchers. The author is most likely basing the paper upon another's or his or her own past work, and often an author will forget to recognize those works. A comprehensive Reference list helps to lend credibility to a technical paper and allows the reader to find related works more easily.

Citing other works is the standard method of authenticating data, crediting other researchers in the field, and guiding the reader to other, similar information. Authors are strongly encouraged to summarize other work in the Introduction of the paper or include a Literature Review section to recognize and cite relevant publications outside of their own work to create more comprehensive manuscripts with greater long-term reference value and greater chance for being cited and for acceptance for publication. Authors should include references to technical papers and journal articles but may also consider books and book chapters if they are truly archival and pertinent to the technical paper.

References also allow one to distinguish what work has already been done and what new information is being presented in the current paper. For an event or non-event technical paper, it is strongly recommended that there be a minimum of 10-15 related references in the paper.

Authors should not rely on websites, private communications, textbooks, manuals, and technical data sheets but should, instead, include references of technical papers and scholarly journal articles. At least 8 relevant journal articles published in the most recent 3 years are recommended to include in the references.

The best-quality event papers (with a minimum of 15 references) will be considered for selection to the *SAE International Journal of Advances and Current Practices in Mobility,* which publishes the top papers from each event at a time after the event, and authors will be informed by email if selected.

In the body of the paper, citations should be numerically identified using square brackets inserted in the text and numbered sequentially in order of appearance, as in [1,2] or [1-3]. The citations are listed in the References section of the paper.

Body of the Paper

General Overview

A paper will have several sections necessary to provide different types of information. Examples of these sections include Abstract, Keywords, Introduction, "Body of the Paper," Conclusion(s), References, and Acknowledgements. The body of the paper should include a detailed and structured description of the work performed, including (as appropriate) methodology, assumptions, hardware, observations, analysis, and a comparison of results with prior work.

Each section starts with a subhead. Following the Introduction is the "Body of the Paper." This is the main section of the paper where the actual work is discussed. This section is not entitled "Body of the Paper." Rather, it is comprised of multiple sections and subsections titled/labeled using topical headings in a multi-level structure suitable for the work presented. The subsections should start with a subheading. Likewise, there could be sub-subheadings within a subsection. Although no specific heading titles are mandated, common examples include Methods, Results, and Discussion.

This main section shall include a detailed and structured description of the work performed, including (as appropriate) methodology, assumptions, hardware, observations, analysis, and a comparison of results with prior work. This may include theoretical work, analytical derivation, measurements, and such other topics.

The information presented shall be self-contained (in the sense that the reader is not assumed to have read

prior papers) and provide an appropriate level of detail for the intended audience; however, references must be used to cite published work on related topics as appropriate. All terms and acronyms must be defined the first time they are mentioned (with the acronym in parentheses) and used consistently throughout the remainder of the paper.

Language Considerations

Standard rules for written English should be followed in the text of the paper. U.S. spelling and grammar should be applied consistently. Standard grammar will ensure that the paper is easily understood by a wide audience, including those not having English as a primary language.

Spell-check and grammar-check software may be used to inspect the written text but should not be a substitute for a thorough personal review. A review by authors fluent in English is one way to check the grammar, but this must be completed prior to the SAE peer-review process. (Official SAE reviewers and organizers do not provide this service.) The complexity of the technical subject or an author's difficulty with technical writing are never excuses to avoid following these guidelines. A person unfamiliar with the topic should be able to read the paper and understand the general theme.

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Commercialism

The paper shall not be commercial in nature. Any commercialism should be eliminated and commercial overtones limited; however, the inclusion of the names of any hardware, software, or other tools used in the technical analysis, evaluation, or methodology is permissible if these are cited properly, as mentioned here. Note that a commercial reference (e.g., product name) may be mentioned once each in the Title, Abstract, and Introduction (for instance, to mention the trade name of a product that is the subject of a paper). Alternatively, a commercial reference may be placed at the end of the paper in an Acknowledgements section. There is no restriction on the number of citable (published) commercial references in the References section, but these should be kept to a minimum. More information on commercialism is located at https://www.sae.org/publications/author/commercialism-guidelines.

The following is an example of a statement demonstrating unacceptable commercialism or advertising: "Tests on XYZ Corporation's Superproduct 1000 have demonstrated the superior quality of our product."

Avoidance of Personal Opinions

Personal opinions and exaggerations should be avoided in writing a technical paper. A few examples of types of opinions follow, which should be avoided:

- Editorial comments, such as: "The jet aircraft costs $5,500,000. This is a substantial sum of money despite the casualness with which million-dollar sums are bandied about these days."
- Personal history, such as: "The first military pre-stressing problem that came to my desk was in 1938 in connection with a request from the Army that we increase the displacement of its truck engines."
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Plagiarism and Self-Plagiarism

The paper shall not have any plagiarism. Plagiarism is committed when an author purposely uses one's own or someone else's previous work, language, thoughts, or ideas without acknowledging the original source and/or getting proper approval from the original source. Plagiarism is defined as the unauthorized and/or unacknowledged use or imitation of works, language, and ideas of another. Generally, in the context of publication, plagiarism occurs when one researcher/author uses the words, language, tables/figures, or ideas of another researcher/author without making it clear within the text or referencing of

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Units of Measure

The long-term goal for SAE is international communication with minimal effort and confusion; therefore, the use of SI units in all technical publications and presentations is required.

SAE also recognizes that sectors of the mobility market do not yet use SI units because of tradition, regulatory language, or other reasons. Mandating the use of SI units in these cases will impede, rather than facilitate, technical communication; therefore, it is the policy to allow non-SI units and dual dimensioning where communication will be enhanced.

Example of Units

The general rule for capitalization is based on whether the unit was based on a proper noun, e.g., Newton. A few examples of units are shown here:

- Hz
- dB
- km
- Nm
- kPa
- KHz

Methodology

While writing a technical paper, the author shall state clearly everything that is necessary in setting up the work. This may include a description of any hypotheses, all implicit and explicit assumptions, equations, boundary conditions, different analysis techniques for solving analytical problems, equation verification, measurement setup, and all other pertinent items that make this paper a quality paper. The author shall use correct and consistent terminology used in the discipline. Addressing these elements properly is not only important for the credibility of the author and the paper, but also for successive researchers to classify the work and to duplicate the study should that be required.

A few specific items for preparing a paper based on experimental work include the following:

- a description of the work and method used
- a description of the measurement setup such that the experiment can be reproduced by others
- a discussion of the basis of the measuring principle/comments on the accuracy, precautions, and limitations on the measurement technique in general

The paper should not list the equipment used like it may be listed in a laboratory report unless some specific equipment needs to be described to understand the work. An example of this could be: An HP Geiger counter, model xyz, was used to do the work. However, the serial number of the equipment should not be mentioned.

For simulation and analytical work, the system model needs to be described clearly. This includes identifying any commercially available software that may have been used to do the study. If proprietary software or special software has been developed, then the fundamental equations that are involved need to be discussed and identified so the credibility of the work is substantiated; however, the author must be careful so that there is no commercialism or commercial overtone. Information on various quality metrics, such as mesh geometry, justification of mesh sizes, and/or nodal boundary conditions needs to be provided.

Analysis

Analysis could be of two types, qualitative and quantitative. Qualitative means obtaining an in-depth understanding of properties of the product or the solution obtained. Quantitative means obtaining numerical values of the product or the solution obtained and thereby determining the performance metric of the product and/or the solution. These should be clearly discussed and explained for the long-term value of the work. In discussing the analysis process, tables, graphs, and photographs should be used to help visualize and explain the results of the analysis. The tables, graphs, and photographs need to be explained clearly to convey what they mean/stand for as opposed to just mentioning that the results are shown in the figure. Wherever possible, comparison

results should be provided in graphical form rather than tabular form.

Examples of Illustrations, Equations, and Tables

This section provides examples of various illustrations or tables that may be used to prepare a quality paper.

Examples of Equations

Three examples of equations are shown here. All equations wider than 3.5 inches must be wrapped to the next line as shown in Equation 2. For more information on how to split an equation, see the SAE Style Guide. Variables used in equations need to be defined in a Nomenclature section at the end of the paper or following the actual equation as shown in Equation 3.

$$\frac{d\lambda}{dt} = \left[\frac{\sqrt{1+161\left(\frac{x}{x^+}\right)^2}-12}{2(A/F)_{st}} - \frac{\sqrt{1+161\left(\frac{x_{prev}}{x^+}\right)^2}-1}{2(A/F)_{st}}\right](1 - BGF_{st}) \cdot \frac{12}{(\mathrm{t}-\mathrm{t}_{\mathrm{prev}})} \quad (1)$$

$$\Delta K_{aero\_f}(0) = -\frac{1}{2}\frac{\partial K_f}{\partial W_f} L_{aero\_f} + \ldots + \frac{1}{2l}\left(l_r \frac{\partial F_{aero\_y}}{\partial \beta} + \frac{\partial M_{aero\_z}}{\partial \beta}\right)\left(\frac{l_f}{l_r K_r} - \frac{l}{mV^2}\right) K_f \quad (2)$$

$$N = L^m \quad (3)$$

where:

N = number of possible designs
L = number of levels for each factor
m = number of factors

Examples of Figures

Three examples of figures are shown:

- photograph
- a schematic or qualitative data
- graphical presentation of data

For a schematic or qualitative data presentation, the axes should be identified and should be legible if printed on an 8.5"x11" or A4 size paper.

When plotting data in a graphical form, all the axes should be labeled with the proper units. If, for proprietary reasons, the actual data cannot be shared, the data should be non-dimensionalized, normalized, or provide relative data for presentation purposes. The axes information, including the numerical values of the tick marks, should be legible if printed on an 8.5" x 11" or A4 size paper.

Figure 1. Example of a figure and figure caption, which is reprinted from another source. The sample figure has been sized to 3.5 inches wide, which is the recommended size. Captions for figures are placed below the figure. Reprinted from Ref. [X] with permission from Publisher Name. © Year, Publisher Name.

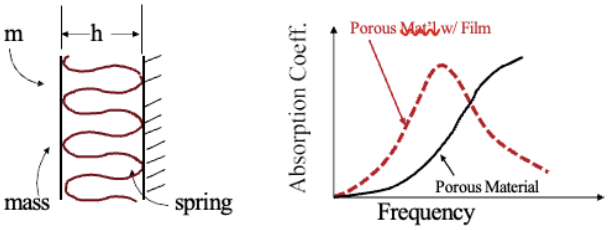

Figure 2. Example of a schematic and qualitative data.

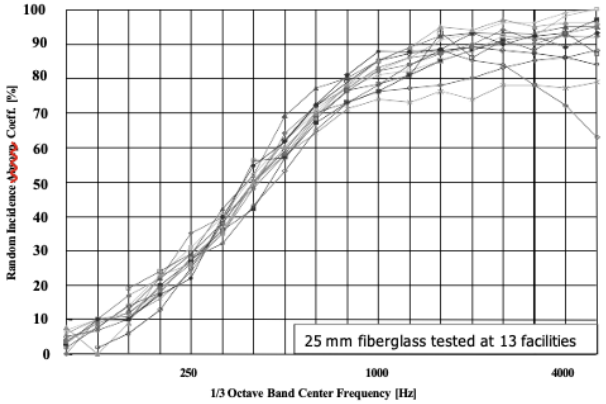

Figure 3. An example of a graphical figure used for data presentation with a reference to related work (data from Ref. [5]).

Table 1. Example of a table and table title. The title for a table is placed above the table. For tables, the recommended size is 3.5 inches. See below the table for an example of an attribution for the data that was taken from another source to create the table.

Displaced volume	1966 cc
Stroke	154 mm
Bore	127.5 mm
Connecting Rod	255 mm
Compression ratio	14.3:1
Number of Valves	4
Exhaust Valve Open	34° BBDC @ 0.15 mm lift
Exhaust Valve Close	6° BTDC @ 0.15 mm lift
Inlet Valve Open	2° BTDC @ 0.15 mm lift

Data taken from Ref. [X].

Example of Table

Table 1 above is an example that includes a footnote sample for the use of data from another source.

Summary: Illustrations, Equations, and Tables

The preferred size for equations, figures, and tables is 3.5 inches or one column width. If these elements are such that they cannot be placed in a 3.5-inch space (i.e., in one column), they can be placed using the entire width of the page (i.e., using both columns). (Requests to increase or decrease image sizes prior to publishing cannot be honored.) Please keep in mind the sizing when labeling your figures so that they are readable.

How to Cite References

Only publicly available references may be used. Scientific and engineering peer-reviewed publication is the basis for all engineering and scientific claims. All claims or statement of facts made in the paper shall be supported by references. An occasional exception to this would be a "private communication." Referencing material posted on the general internet is discouraged because it may not have a long-term value because the information may be removed from the internet at a future time and therefore not searchable. If such a reference is added, the date when it was accessed should be included in the reference.

Authors should provide direct references to original research sources whenever possible. References to review articles can be an efficient way to guide readers to a body of literature but may not always reflect original work accurately.

References need to be compiled in numerical order as they are cited in the paper. Each reference is cited using a number within square brackets [1]. These are numbered sequentially in the order of first appearance. It is strongly encouraged to include works that are not older than 10 years. Examples of references are provided at the end of this document under the heading of References. The list of references is to be provided at the end of the paper, after Summary/Conclusion(s) (and Recommendation, if present) and before Acknowledgements or other closing sections.

Depending on the content of the work, references should also be cited under different sections or subsections, such as Introduction, Literature Review, Methodology, Analysis, or other section. Authors should not reference information that could change or that may not be available at a later time. An example of this is certain information posted on the internet (company website, blog, Wikipedia®, etc.) unless the information is truly archival.

References to "private communication" shall only be used to support non-critical content claims and if essential information is not available in the public domain or research works.

All details of the reference citation need to be accurate: author, title of article, proceedings, journal title, volume and page numbers where it was presented, date published, DOI, etc. SAE follows the *Chicago Manual of Style* for references.

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Table 2 includes a list of different types of references with the corresponding Reference numbers, which are included in the References list below.

Table 2. Reference examples.

Reference Type	Corresponding Reference Number
Personal Communication	[1]
Video	[16]
General Website	[17]
Book	[2] (with chapter reference,) [11] (with page numbers)
Conference/technical paper or presentation with no DOI	[5]
Conference/technical paper with paper number or DOI	[3,4,18]
Journal article	[6,7]
Journal article with DOI	[19-33]
Magazine article	[8]
Standards	[9,10]
Patent	[12]
Thesis/Dissertation	[13]
Software	[14]
CD-ROM	[15]

For complete formatting guidelines, please visit http://volunteers.sae.org/authors/FormattingCitations.pdf.

Discussion

This section of a paper is important because the objective is to provide an interpretation of the data and important findings of the work discussed in earlier sections. This section also leads to the Summary/Conclusion(s).

Summary/Conclusions

Serving several purposes, this section shall state a summary of the key learnings from the work presented, including the problem and the solution. This section should also state precautions, limitations, and disadvantages of the work, if any. Depending on the work, this section may also include an explanation on the impact of this work on future work.

Recommendations

The Conclusion(s) may often result in some kind of a recommendation. When done properly, the Conclusions and Recommendations will be separate sections that can easily define the value of the work and can, in fact, generate future work as a result.

References

SAE uses the *Chicago Manual of Style* in formatting references. Within the text of the paper, the citations are numerically identified using square brackets [1]. Up to four authors should be listed in a citation; with more than four authors, et al. should be used after the fourth author is listed. Refer to the SAE Formatting References Guide for the style of different types of references. Authors should ensure that all references are cited within the text in numerical order, and it is strongly recommended to have at least 15 references if you would like your paper to be considered for the *SAE International Journal of Advances and Current Practices in Mobility.*

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SA	Sample abbreviations
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$$STL = 10\log_{10}\left[\left\{\left|1+\eta\left(\frac{P_s\omega Cos\theta}{2\rho c}\right)\left(\frac{B\omega^2}{P_s c^4}Sin^4\theta\right)\right|\right\}+\left(\frac{P_s\omega Cos\theta}{2\rho c}\right)^2\left(1-\frac{B\omega^2 Sin^4\theta}{P_s c^4}\right)\right|^2 \quad \text{(A1)}$$

Table A1. DOE cases considered and their effect on the study.

			Influence of Different Factors (%)		
Frequency Range	Frequency (Hz)	General System Behavior	Ratio of Wear to Mass-Filled Layer Density	Mass-Filled Layer Thickness	Decoupler Density
Range 1	125 to 315	Coupled System	3	10	86
Range 2	400 to 1000	Double Wall Resonance Effects	1	3	96
Range 3	1250 to 3150	Transition Region	3	3	90
Range 4	4000 to 8000	Double Wall Decoupled Region	7	7	77

Appendices can be structured using the same subsection headings and formatting used in other sections of the paper. When labeling figures, tables, and equations within an appendix, restart the numbering in each appendix and prefix the number with the letter of the appendix, e.g., Figure A7, Eq. (A1), Figure B1, etc.

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