How to Write a Technical Paper *

— Version 1.2.10 —

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December 4, 2023

Abstract

This document provides an overview of how to approach writing technical papers such as journal or conference papers. The content provides information as to what should go into different sections, as well as how to do some common TeX typesetting.

The abstract of the paper should be a concise summary of what the paper is about. These are often limited to 200-300 words. Mention first the general topic area, what is new about this paper, briefly discuss how it relates to earlier work, and summarize the results and content of the paper. The reader should be able to learn what this paper is about, what is new, and how the new work is done (analytical versus computation versus experimental.

*The title often needs to be 12 words or less. Try to be as specific as possible, not make the title too generic such as (3-craft control). Otherwise, in future papers, you'll struggle to differentiate what is new in the following papers, as the title of the first papers appears to cover the entire topic area already. Also, don't use acronyms in the title. Think of the title as a "mini-abstract".

†Add all authors that intellectually contributed to this paper. Include the proper, and updated, author affiliations including title, employer, and location. Some journals also want the authors affiliation status, such as "Senior AIAA Member." **Be sure to include your advisor.** If someone helps in some way (general discussions, helps run software, do experiments, etc.) then they should be added to the acknoledgement section at the end of the paper, not as a co-author.

Contents

1 Introduction Section

The introduction section should the following items, roughly in the order listed:

- Motivation for the technical work discussed in this paper. Start out talking about why the general topic you are discussing in this paper should be of interest to the reader. Provide references as needed.
- Provide a broad literature review of this topic area.
- Provide a concise statement of the topic area being discussed in this paper.
- Compare and contrast this new work to earlier work, providing good references to the original work. Point out to the reader why this paper provides new technical content that is worthy of a journal submission.
- Discuss the scope of the technical work being presented. This is a very important component to avoid having the reader think you are solving a broad, general problem, whereas your paper actually discusses a particular sub-component development.
- Provide a brief outline of the papers content, highlighting what sections are included.

Note, *the introduction should not discuss results*. Rather, the goal of this section is to provide the general motivation of the paper, explain how it relates to earlier work, and discuss what new technical work is of interest and is examined in this publication.

2 General Writing Guidelines

2.1 Sample Paper Layout

The paper should have a structure that is clean and easy to follow. Try to avoid overly long sections. Rather, try to break them down into appropriate sub-sections. Also, be careful to not have section which contain a single sub-section. In this case, integrate this sub-section with the parent section, or add more sub-section divisions as needed.

The paper Should be structured as:

- Abstract: see above for comments on this
- Introduction: see above for comments on this
- Problem Statement: Here the basic mathematics of the present work are discussed including basic EOMs being developed, coordinate frames are presented through illustrations, etc. This section usually doesn't contain new material, but is a brief review of what material the reader should be familiar with
- New topics to present the material
- Numerical Simulations, or Experimental Results
- Conclusions: , see below for comments on this

2.2 Paper Formating

Use journal or conference templates whenever possible. Also, even if you already have a template, it is best to re-examine the latest official paper submission guides to make sure you are familiar with them. For general help on LaTeX formatting, please consult the many online resources that exist. For example, http://en.wikibooks.org/wiki/LaTeX/ provides a good general introduction to the basics of LaTeX.

2.3 Paper Tense

This one trips up many prospective authors. The general tense of a technical astrodynamics publication is ***present tense***. Sounds simple, but despite this instruction, many will still use past and present tense, leading to a lengthier paper editing and review cycle. Here are some common issues.

- If talking about other papers that were written the past still use ***present tense***. After all, these papers still exist, and they still make these claims. For example, instead of writing

  > *Reference 21 discussed for the first time the use of thrusters to control the attitude.*

  You could write

  > *Reference 21 discusses the first occurrence of using thrusters to control the attitude.*

- If you are talking about items this paper addresses using future tense, still use ***present tense***. Again, same reasoning as with the references discussions. This paper right now presents these results, present tense. The reader simply hasn't reach that part of the paper yet. For example, instead of writing

  > *This paper will investigate the use of thruster to control spacecraft orientations.*

  You could write

  > *This paper investigates in section 3 and 4 the use of thruster to control spacecraft orientations.*

- If you are talking about particular events that happend in the past, then do use past tense. For example, consider the statement

  > *In 1998 occurred the first space qualification of the use of thrusters for attitude control.*

  Here it would not make sense to use present tense as a specific 1998 event is being discussed. However, if talking about a report that discusses the results of this flight test, then you would again use present tense as in:

  > *Reference 31 discusses how the STS-32 mission demonstrated the first use of thrusters to control the spacecrafts orientation.*

- If discussing future work that has not been performed yet, then it makes sense to use future tense. For example:

  > *This work only considered the full-state feedback case. Future work will investigate scenarios with thruster failures and the resulting under-actuated control challenges.*

2.4 Including Tables

A table of parameters and values is an effective and compact method to present such values. In contrast, if you list 15 simulation parameters within a text paragraph, it makes it harder for the reader to extract the values used. Note that a table should have it's table number and caption centered above the table as shown in Table 1

The TeX source code for this sample table is:

Table 1: title here

header1	header2	header3
x	x	x

```
\begin{table}[htb]
   \caption{title here}\label{tab:1} \center{
   \begin{tabular}{ c  |  c | l }
      \hline
      header1 & header2 & header3 \\
      \hline
      x & x & x  \\
      \hline
   \end{tabular}
   }
\end{table}
```

Note the label reference is added before the tabular environment. The general formatting of the table is controlled with the {c | c | l} statement which stands for center, center and left justified columns. More information of formatting LaTeX tables can be found on web sites such as http://en.wikibooks.org/wiki/LaTeX/Tables.

The placement of the TeX table is controlled through the standard [htb] identifies, here "h" stands for here, "t" stand for top, and "b" stands for bottom of page.

2.5 Using Unbreakable Spaces

LaTeX has a nice feature where you can add unbreakable spaces. This is very convenient when you have something like "Figure 1" and you want to assure that "Figure" and "1" are typeset together on the same line. You do this with the tilde symbol such as:

```
   As seen in Figure~\ref{fig:fig1}, the temperature increased over this maneuver.
```

Please use this tilde-unbreakable space symbol when you are referring to figures, tables, equations, or references.

3 Mathematical Typesetting

The mathematical typesetting ability of LaTeX is one of the strong points of use TeX to write technical papers. This section assumes the reader has already become familiar with the basics of math in TeX, and will address only particular advanced topics.

3.1 Denoting Vectors

In the journals, a vector quantity is typically denoted through a bold variable. The package

```
\usepackage{bm}
```

is very useful to render any variable into a bold version. Try to avoid arrows, overbars, underbars, etc. to denote vectors. It will just cause confusion with the journal typesetter. Thus to create the typeset equation

$$\boldsymbol{b} \cdot \boldsymbol{\sigma}_1 = 20 \tag{1}$$

we use the code:

```
\begin{equation}
   \bm b \cdot {\bm \sigma}_{1} = 20
\end{equation}
```

Note that the `\bm` command can be used even on greek characters.

To denote that a vector is being expressed in $\mathcal{B}$ frame components, I tend to use a left-superscript such as

$$ {}^{\mathcal{B}}\boldsymbol{v} = {}^{\mathcal{B}}\begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix} \tag{2}$$

The TEX code for this example is:

```
\begin{equation}
   {}^{\mathcal{B}}\bm v =
   {\begin{matrix} ~ \\ ~ \\ ~ \end{matrix}}^{\mathcal{B}\!\!\!}
   \begin{bmatrix} v_{1} \\ v_{2} \\ v_{3} \end{bmatrix}
\end{equation}
```

Note this example also illustrate how to add the left super-script to a matrix representation of a vector. The `\!` command adds some small amount of negative space. The number of negative space commands needed to make this look good depends on the frame letter used.

Unit vectors such as $\hat{\boldsymbol{b}}_1$ should be typeset with a hat symbol. Note that the hat should only be over the letter, not any sub-scripts. The code for $\hat{\boldsymbol{b}}_1$ is

```
   $\hat{\bm b}_{1}$
```

3.2 Differential Operators

Consider the following mathematical equation typesetting:

$$\frac{\mathrm{d}}{\mathrm{d}t}\left(\cos(\theta) + d\right) = -\sin(\theta)\dot{\theta} + \dot{d} \tag{3}$$

A function such as the cosine $(\cos)$ or sinus $(\sin)$ function is typeset in non-slanted, times roman fonts. This is in contrast to a variable d which is typeset in an italic times roman font. To avoid confusion between the parameter d and the differential operator d, the `AVS.sty` package defines the handy macro `\D`. The TEX source of the above example is

```
\begin{equation}
   \frac{\D}{\D t} \left( \cos(\theta) + d \right)
   = - \sin(\theta) \dot\theta + \dot d
\end{equation}
```

3.3 Subscripts with Names

Some variable subscripts are simple counters, such as v_i. Here the i is typeset as a variable, i.e. in italic font. However, if names are used in the sub-script, these should not be type-set in italic, but rather using non-italic fonts. Thus, the maximum velocity variable $v_{\max}$, should be typeset using

```
v_{\text{max}}
```

rather than v_{max}. In the latter case it is unclear if the m, a and x variables are indices or not.

3.4 Equation Spacing

When typesetting mathematical equations which are on their own lines, leaving an empty line between the math and the text around it tells TEX that a new paragraph should be started. Thus, extra vertical space is added between the equations and the text, and the text is indented if the journal styles has new paragraphs being indented. Only do this if you truly want to start a new paragraph. For most case, there should be no empty lines between the math and the text as shown in the following example.

```
Sed mattis rutrum ultricies. Integer ac mi at felis porta pharetra
vel eu felis. Nulla vel euismod velit. Mauris sit amet sapien odio, eget facilisis diam.
\begin{equation}
   \label{eq:label1}
   \bm h = \bm r \times \dot{\bm r}
\end{equation}
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam ut imperdiet lacus.
Morbi quis est velit. Sed mattis rutrum ultricies.
```

which yields

Sed mattis rutrum ultricies. Integer ac mi at felis porta pharetra vel eu felis. Nulla vel euismod velit. Mauris sit amet sapien odio, eget facilisis diam.

$$\boldsymbol{h} = \boldsymbol{r} \times \dot{\boldsymbol{r}} \tag{4}$$

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam ut imperdiet lacus. Morbi quis est velit. Sed mattis rutrum ultricies.

instead of

Sed mattis rutrum ultricies. Integer ac mi at felis porta pharetra vel eu felis. Nulla vel euismod velit. Mauris sit amet sapien odio, eget facilisis diam.

$$\boldsymbol{h} = \boldsymbol{r} \times \dot{\boldsymbol{r}} \tag{5}$$

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam ut imperdiet lacus. Morbi quis est velit. Sed mattis rutrum ultricies.

if empty lines are added between the text and the math. Note the extra space that is now introduced above the equation.

3.5 Coordinate Frame Definitions

To denote a variable as defining a coordinate frame, I use caligraphic fonts in TEX. To typeset something like $\mathcal{C}:\{\hat{\boldsymbol{c}}_1, \hat{\boldsymbol{c}}_2, \hat{\boldsymbol{c}}_3\}$, I use

```
\mathcal{C}:\{\hat{\bm c}_{1}, \hat{\bm c}_{2}, \hat{\bm c}_{3} \}
```

The `AVS.sty` has a handy macro definition `\frameDefinition{c}` that produces:

$$\mathcal{C}:\{\hat{\boldsymbol{c}}_1, \hat{\boldsymbol{c}}_2, \hat{\boldsymbol{c}}_3\}$$

Note that this command can be called in the text of math mode.

3.6 Degree Symbol

The `AVS.sty` has a handy macro definition `\dg` that produces:

$$a = 5^\circ$$

Note that this command can be called in the text of math mode.

3.7 Mathcal Left-Superscript Symbol to denote the Coordinate Frame of a Matrix Represenation

The `AVS.sty` has a handy macro definition `\leftexp` . With it, the TEXcode

```
\leftexp{B}{\bm a} = \leftexp{B}{
    \begin{bmatrix}
      1 \\ 2 \\ 3
    \end{bmatrix}
}
```

produces this output:

$$^{\mathcal{B}}\boldsymbol{a} = {}^{\mathcal{B}}\begin{bmatrix}1\\2\\3\end{bmatrix}$$

However, note that the left exponent can't have subscript. To be able to add more general left-exponents, use the macro `\leftexpGeneral` . Here

```
\leftexpGeneral{{\mathcal{B}_{0,i}}}{\bm a} = \leftexpGeneral{{\mathcal{B}_{0,i}}}{
    \begin{bmatrix}
      1 \\ 2 \\ 3
    \end{bmatrix}
}
```

produces this output:

$$^{\mathcal{B}_{0,i}}\boldsymbol{a} = {}^{\mathcal{B}_{0,i}}\begin{bmatrix}1\\2\\3\end{bmatrix}$$

3.8 AMSmath package

The AMSmath package provides many convenient typesetting capabilities for mathematical expressions. This subsection will highlight a few. The package is discussed more at

http://www.ams.org/publications/authors/tex/amslatex

Note, most LaTeX journal and conference papers templates already automatically include the AMS-LaTeX package. If it is not included, it must be added usign

```
\usepackage{amsmath}
```

A PDF guide to this package can be found at

ftp://ftp.ams.org/pub/tex/doc/amsmath/short-math-guide.pdf

3.8.1 Equation Reference

To refer to equation numbers within the text, it should like this, see Eq. (1), where equation number is embedded within round brackets. There is the following short-cut to achieve this:

```
\eqref{eq:ax1}
```

instead of using the more tedious `(\{eq:ax1})`.

3.8.2 Multi-Line Equations

Often equations are presenting as a group, or a large equation is split across several lines. The AMS-LaTeX package provides very convenient environments to achieve this in a simple manner.

Consider the case where you want to show several steps of developing an expression, but just give it one equation number, such as in

$$\begin{aligned} a &= b + c - d + e - f \\ &= g + h \\ &= i \end{aligned} \tag{6}$$

This is achieved with the `split` command. The LaTeX code this is

```
\begin{equation}\label{eq:xx}
   \begin{split}
      a& =b+c-d +e-f \\
      & =g+h
      \\ & =i
   \end{split}
\end{equation}
```

If the equation is too long to fit on a single line, you might want to break this equation across multiple lines. Here the equation number should only be on the last line. This is achieved with `multline` command. A sample is:

$$a = \int_1^{t_f} \Big[\sin\theta + \cos\beta - \tan(2+\theta^2-\theta)\Big]\mathrm{d}t + \theta^3 + (2+\dot{\theta})^3 \left[\int_1^{t_f} \Big[\sin\theta + \cos\beta - \tan(2+\theta^2-\theta)\Big]\right](\theta + t\dot{\theta})^3 \tag{7}$$

The LaTeX code this is

```
\begin{multline} \label{eq:xx}
   a = \int_{1}^{t_{f}} \Big[  \sin\theta + \cos\beta - \tan(2+\theta^{2} - \theta) \Big]
   {\mathrm d}t + \theta^{3}+(2+\dot\theta)^{3} \\
    \Bigg [
     \int_{1}^{t_{f}} \Big[  \sin\theta + \cos\beta - \tan(2+\theta^{2} - \theta) \Big]
     \Bigg ](\theta + t \dot\theta)^{3}
\end{multline}
```

Another common need is to have several consecutive equations have a particular item, such as the equal sign, line up across the lines. This is done using the `align` command to yield the following example.

$$\gamma = b^2 - 2\theta \tag{8}$$
$$\beta = c^2 + 2bc - 3 \tag{9}$$

The & symbol is used to denote at what point the lines should be lined up. The LaTeX code this is

```
\begin{align}
   \label{eq:a1}
   \gamma &= b^{2} - 2\theta \\
   \label{eq:a2.0}
   \beta &= c^{2} + 2bc - 3
\end{align}
```

Note that the equations labels must be given for each equation line.

3.8.3 Sub-Equations

If the equations are closely related, then it makes sense to use one equation number for the set of definitions. However, we still want to be able to reference particular definitions. This can be done using the `subequations` command, as seen in this example:

$$a_1 = b^2 - 2\theta \tag{10a}$$
$$a_2 = c^2 + 2bc - 3 \tag{10b}$$

Note, you can now reference Eq. (10) using `\eqref{eq:s}` , or a sub-equation Eq. (10a) using the command `\eqref{eq:s1}` . The LaTeX code for this example is

```
\begin{subequations}
   \label{eq:s}
   \begin{align}
      \label{eq:s1}
      a_{1} &= b^{2} - 2\theta \\
      \label{eq:a2.2}
      a_{2} &= c^{2} + 2bc - 3
   \end{align}
\end{subequations}
```

3.8.4 Special Symbols

It must be noted that the AMS-LaTeX package provides a large number of additional mathematical symbols. See the above documentation link for a complete listing.

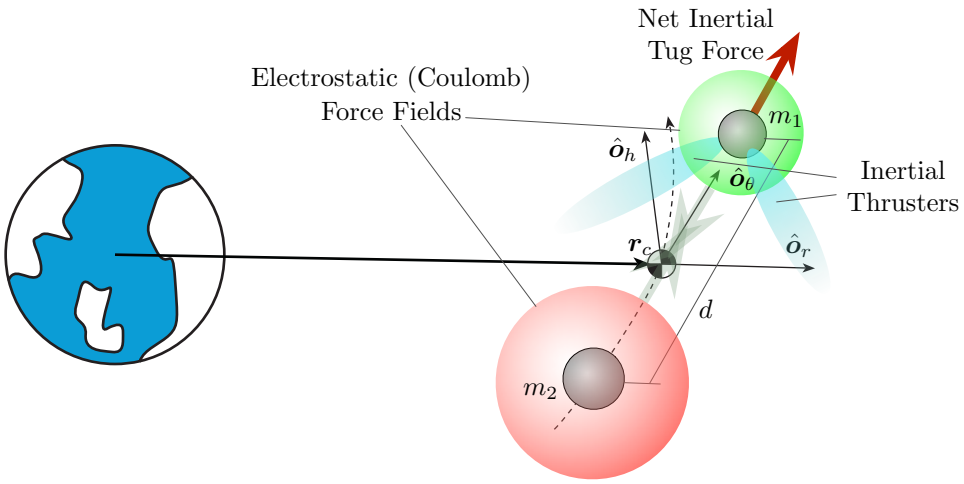


Figure 1: Caption Text Goes Here.

4 Including Graphics and Illustrations

4.1 Preferred Image Format

The PDFTEX version of LATEX allows for PDF graphics to be directly imported into the document. This avoids the need to store the images with the less-used *.eps format. Bit-mapped graphics can also be imported, such as *.png or *.jpg files, but should be avoided if possible. The PDF graphics format can embed bit-map graphics, such as photos, and provides a vector-based method of drawing lines, figures, and text. Being vector based, such files will be displayed at the best possible resolution for computer monitors, but also for printed versions.

4.2 Image Locations

Further, it is strongly suggested that the figures used in a paper are stored within a separated sub-folder, such as `Figures`. Supporting documents such as the OmniGraffle drawing programs, un-modified *.eps, etc., should be stored in another sub-folder called `Support`. This allows all the graphics related files be stored within the main TEX folder. Further, if a journal paper is published, the publisher will require a folder of the images used With this file structure, you will not need to later separate used figures and support documents, but you already have them split cleanly into two groups.

4.3 Including a Single Image

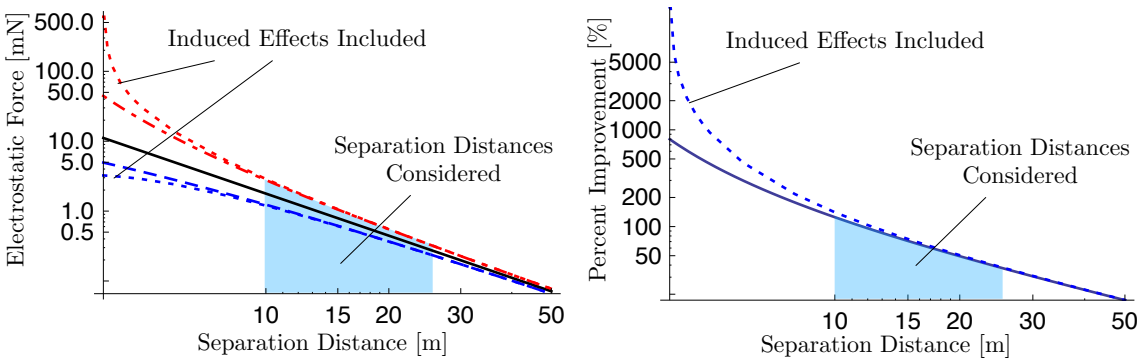
To import images, you need to include the package:

```
\usepackage{graphicx}
```

Note that many journal and conference paper style files already include this, and you many not need to explicitly include this.

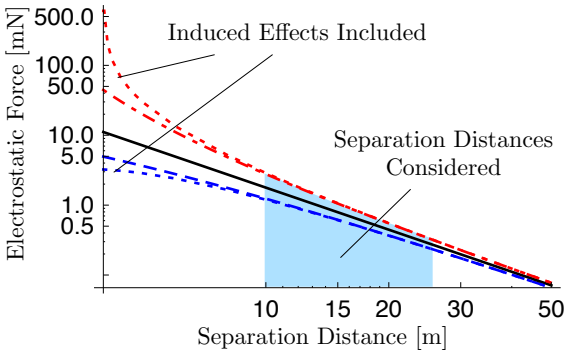
To include a single image, such as shown in Figure 1, you can use the generic code:

```
\begin{figure}[tb]
   \centerline{
   \includegraphics[]{Figures/image}
   }
```



(a) sub-figure caption text here

(b) sub-figure caption text here



(c) sub-figure caption text here

Figure 2: Caption title here for the grouping of sub-figures.

```
    \caption{Caption Text Goes Here.}
    \label{fig:image}
\end{figure}
```

Note that the figure caption must be added *after* the `\caption` command. By default, I suggest to include the figure at the top of a page, or the bottom if needed. If you want to place the figure within the text flow, you can use the `h` as well. If you are including a very large figure, use the letter `p`.

Note that the image type does not have to be specified in this code. The import command will grab either `image.pdf` or `image.png`. Leaving out the file extension makes it easier to replace one image with another image of a different type.

4.4 Including Sub-Figures

To include a set of figures using subfigures, you need to include the package

```
    \usepackage{subfigure}
```

To include a set of sub-figure, you can use the template TEX code:

```
\begin{figure}[tb]
    \centering
    \subfigure[sub-figure caption text here]
    {\label{fig:label1}
    \includegraphics[]{Figures/image-a}}
```

```
   \subfigure[sub-figure caption text here]
   {\label{fig:label2}
   \includegraphics[]{Figures/image-b}}
   \\
   \subfigure[sub-figure caption text here]
   {\label{fig:label3}
   \includegraphics[]{Figures/image-a}}
   \caption{Caption title here for the grouping of sub-figures.}
   \label{fig:img}
\end{figure}
```

Most of this code is self-explanatory. The point at which a line break is added is controlled with the newline command. Also, note that each figure has its own label such as Figure 2(c), while the grouping of figures can be referenced as Figure 2.

4.5 Scaling the Figures

You may have noticed that the above figure inclusions don't contain a figure scale command. It is strongly recommended that the figure be created at the proper size such that a scale command is note required. If you do want to scale the image, you can use the code snippets

```
   \includegraphics[width=.5\textwidth]{Figures/image}
   \includegraphics[width=.9\columnwidth]{Figures/image}
   \includegraphics[width=4in]{Figures/image}
   \includegraphics[scale=0.75,angle=90]{Figures/image}
```

The TEX command `\textwidth` is a convenient way to make the figure a multiplier of the text width, the `\columnwidth` command does the same with columns.

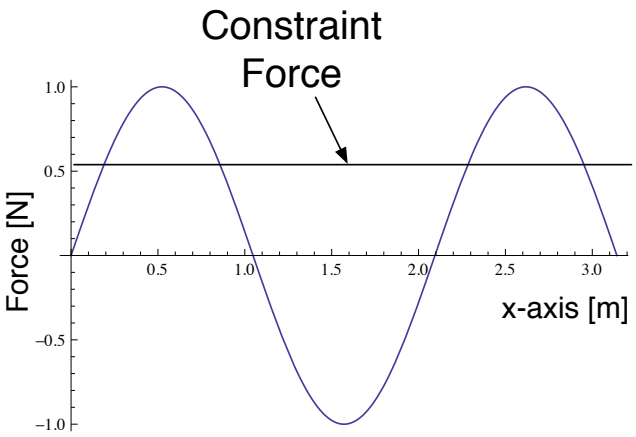
Here are some suggestions on making good paper illustrations:

- Use a good image editing program that allows to create PDF vector graphics as the output.
- Scale the image in the editor to be roughly the size you want in the end. This allows you to added labels and text comments using a predictable font size such as 9 point fonts. Otherwise, if you scale the final image by a factor of 2 when you import it into the document, you must do all the tedious math to scale the fonts as well such that they have the desired size in the final document. This is illustrated in Figure 3.
- Try to keep all the text labels and fonts at a consistent size. Numerical simulations plots might have other font sizes for the axes labels, but even these should ideally be consistent, and readable.
- If you can, try to create the text labels using a TeX program, and then copy them into the illustration editor. On Mac OS X, the program `LaTeXiT` is a very convenient tool to do this.

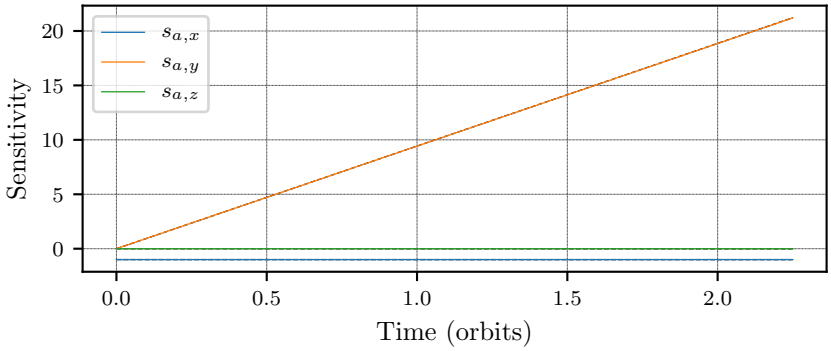
4.6 Placing the Figures

The figure placement is controlled through the `[htbp]` tag of the `\begin{figure}` command. The *top* tag `t` tries to place the figure at the top of the page. This is the preferred tag for most figures as it produces a more professional looking output. If you want the figure to show up within the text flow, then use the *here* tag `h` . The *bottom* tag `b` puts the figure at the bottom of the page. To achieve place the figure(s) on a separate page, the *page* tag `p` can be used.

LATEX goes through lots of effort to try to determine the correct figure placement while keeping the paper esthetics in mind. You can control the order of the options through the order of the tags. Thus, using `[tbp]`



(a) Scaled image where the font labels use different sizes



(b) Illustration which is drawn to scale, and shows consistent font label sizes.

Figure 3: Illustration of improper font sizing .

says that your first preference is to have the figure at the top, the 2nd preference is to have it at the bottom, and the last option is a full-page layout. If you want to override the LaTeX logic, you can use the exclamation symbol, such as using `[!h]` to force it to appear at the current location within the text flow.

4.7 Using Color Figures and Illustrations

It is good to use color to enhance the readability of the figure, as well as make it look more professional when used in separate presentations. However, always keep in mind that these figures are most likely printed using a gray-scale process for the journal. Thus, using a solid red and blue set of lines can lead to the issue where in the gray-scale version, these lines look the same. Instead, play with different line types such a line thickness, dashed lines, etc. to make them distinguishable.

It is recommended that you test print the paper on a black and white printer to ensure that the output is still readable and professional. If you do want a figure to be published in color, be aware that the journal will charge extra for this.

To make colored lines distinguishable in black and white, you can either use different line types such as dashed, or dotted lines, along with a legend. Or, you can also label the lines directly within the figures.

4.8 Figures of Numerical Simulation Results

Make sure the lines are not too thin, such that they vanish if printed. Also, make sure the axes labels are readable. Try to avoid having Matlab add the 10^{-7} exponent at the top of the axis. Instead, try to use other units to avoid such issues, or have the exponents shown in the figure axis directly. For example, instead of showing charge using Coulomb, or Newtons, try to plot micro-Coulomb or milli-Newtons instead.

4.9 Aspect Ratio of Figures

Please note that you are not a slave to the default aspect ratio that Matlab or Mathematica provides you. The Matlab default image format, in particular, is good for general viewing of the data, but now well suited for publications. It's near-square shape and large size cause lots of white space in the paper (with single-column formats). The size tempts the authors to simple scale the figure to fit, resulting in the axes label fonts being too small to read by normal humans. Instead, try different sizes and aspect ratios that present the data in the best manner, while efficiently using the paper margins.

5 Making Joint Paper Edits with Co-Authors

5.1 Marking Paper Changes by Author

LaTeX does not natively support a version control system that allows us to track small changes co-authors make between documents. However, we can still mark these changes using the following macros. At the top part of the document, be sure to include the `AVS.sty` package. Be sure that you have your edit macros defined in this style file, and are set to use a unique color.

```
\definecolor{colorLJ}{rgb}{0,0,0.9}
\newcommand{\EditlJ}[1]{{\color{colorLJ} #1}}
\newcommand{\EditLJd}[1]{{\color{colorLJ} \sout{ #1}}}
```

I used the "HPS" macros, change the "LJ" letters in the example above to be unique to you. Note that each author has two macros defined to highlight both additions and deletions.

With these macros defined, consider the following the sample paragraph:

> *Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam ut imperdiet lacus. Morbi quis est velit. Sed mattis rutrum ultricies. Integer ac mi at felis porta pharetra vel eu felis. Nulla vel euismod velit. Mauris sit amet sapien odio, eget facilisis diam. Nullam faucibus, sapien nec feugiat pulvinar, nunc velit semper lacus, ut tristique lorem dui bibendum nibh.*

If I want to edit this text, I then use the `\EditHPS` to mark additions, and `\EditHPSd` to mark deletions, to yield:

> *Lorem ipsum dolor sit amet, consectetur adipiscing elit to show some new text added to the text. Nam ut imperdiet lacus. Morbi quis est velit. Sed mattis rutrum ultricies. Integer ac mi at felis porta pharetra vel eu felis. Nulla vel euismod velit. ~~Mauris sit amet sapien odio, eget facilisis diam.~~ Nullam faucibus, ~~sapien nec~~ semper lacus feugiat pulvinar, nunc velit semper lacus, ut tristique lorem dui bibendum nibh.*

The TeX code for this paragraph is

```
Lorem ipsum dolor sit amet, consectetur adipiscing elit \EditHPS{to show some new text
added to the text}. \EditLJ{Nam ut imperdiet lacus.} Morbi quis est velit. Sed mattis
```

```
rutrum ultricies. Integer ac mi at felis porta pharetra vel eu felis. Nulla vel euismod
velit. \EditHPSd{Mauris sit amet sapien odio, eget facilisis diam.} Nullam faucibus,
 \EditLJd{sapien nec} \EditLJ{semper lacus} feugiat pulvinar, nunc velit semper
 lacus, ut tristique lorem dui bibendum nibh.
```

If you are using TeXShop on Mac OS X, note that you can create keyboard short-cuts to make adding these macros easier. For myself, I have added the TeXShop macros

```
\EditHPS{#SEL##INS#}
\EditHPSd{#SEL#}#INS#
```

Which allow me use CMD-OPT-E to added \EditHPS around some selected text, or CMD-OPT-SHIFT-E to add \EditHPSd to mark selected text as a suggested deletion.

5.2 Approving Suggested Changes

Let's say I have marked several suggested changes to the student's paper manuscript. I usually use a red color for my changes, and blue or green for the students changes. Please review all the changes. this is done easily in the ASCII TEX source using a find command for EditHPS occurrences. If you approve of the change (addition or deletion), then please remove the EditHPS commands and associated brackets. In TeXShop , if you click on a bracket, the editor will highlight the enclosed text for your convenience.

If you see a change you don't agree with, then please mark this in some manner, and add your own comments or questions about this change. For example, I often mark general question by adding the text

```
\EditHPS{(HPS: some general question or comment here)}
```

This makes it easier to mark such questions, and mark them as not being part of the document.

Any new changes that you make, please use your own \Editxx macros to show me what edits and changes you are making. If the changes are extensive, then marking each change may not be practical. In this case, just add a general comment that this entire section is rewritten rather than marking all the edits. Common sense rules...

5.3 Adding ToDo's and Temporary Figures

The package AVS.sty include the package todonotes . This is very handy way to add to-do's to your text. For example, the macro \todo can be used in this text

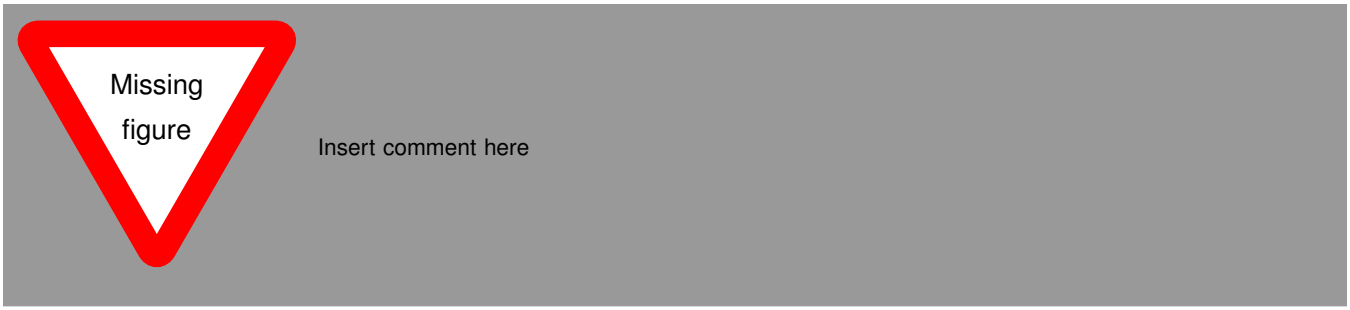
```
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor
incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud
exercitation ullamco laboris nisi ut aliquip ex ea  consequat. \todo{To-Do Text...}
 Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat
nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui
officia deserunt  mollit anim id est laborum.
\todo[inline]{Insert comment here}
```

to yield:

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. To-Do Text
Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Insert comment here

To insert a placeholder figure, the macro `\missingfigure{Insert comment here}` can be used to yield:



6 Paper Writing Timeline

6.1 Submitting Conference Abstracts

If you are submitting a conference abstract, then you should email Dr. Schaub a copy to review at least 1 week in advance. We may iterate a few times on the title.

If a full paper is required for a conference abstract submission, the see the expected timeline guidance of a conference paper.

6.2 Submitting Conference Papers

Never underestimate how much time it will take to make the final edits on a paper. Very often great work is masked by an unpolished and unprofessional presentation. Because all papers coming out of the AVS lab have Dr. Schaub as a co-author, at least, build in enough time to have all co-authors proof read and contribute to the paper. If you are the lead-author, plan ahead to get all the required input you need to complete the sections on time.

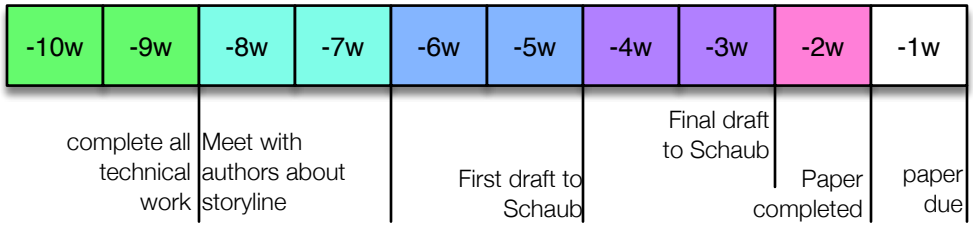


Figure 4: Paper writing timeline approaching the paper due date.

Figure 4 illustrates a suggested timeline scenario as you approach the paper due date. Notice that the last week is left blank as a buffer. Leave a good week for the final draft to go through proof reading, and final edits and tweaks.

- -8w: A good goal is to have the technical work completed 2 months ahead of the deadline.
- 8w: Before you start writing the paper, be sure to meet up with the co-authors to go over the paper's story line. You should story-board what the paper is about, including:
  1. Motivation for work
  2. What is novel in this paper

3. What prior would should be cited or compared against
4. General paper breakdown into sections

- 8-4w: Before the first complete draft goes to Dr. Schaub for review, have some AVS colleague proof read it for your and provide feedback. This helps greatly in streamlining the paper development process.
- 4w: First draft should be sent to Dr. Schaub for review
- 4-2w: Continue to refine the paper as needed, include latest technical results if appropriate, etc.
- 2w: Final paper copy is sent to Dr. Schaub to review

The above timeline is a suggested time line. Life doesn't always work out this way. Here is some hard guidance:

- A complete paper draft, that has been reviewed by peers already, must be submitted to Dr. Schaub at least 2 weeks in advance of the deadline.
- If the paper is not ready, then it is up to the discretion of Dr. Schaub to cancel the student's conference travel and withdraw the paper.
- If the paper, or the research for the paper, is running late, it is strongly advised to keep Dr. Schaub and other co-authors in the loop to see if a reduced scope paper makes sense.

Note that if a co-author is from JPL, AFRL, etc. where the institution requires an internal review for export control compliance, be sure to reach out early to account for the 1-2 months this review process might take.

6.3 Submitting Journal Papers

If you are submitting a journal paper then you don't typically have hard submission deadline. If yes, then use the conference paper guidelines. However, the process is the same in that you need to coordinate with your co-authors on a story line before you start writing a paper. Make sure you know what journal you are writing for (who is the audience, etc.). Make sure the literature review is bullet proof.

7 General Suggestions

7.1 TEX Labels

Before submitting the paper to a journal, conference, or advisor, please make sure that you are not getting any TEX errors. In particular, look at the TEX console to see if you have some label names duplicated, or if you are using undefined references to equations or figures.

7.2 Paper Sharing

When sharing the paper with co-authors, be sure to email them all files required for them to TEX the paper on their end as well. This means, you should include the *.tex file, the `Figures` sub-folder, the *.bbl file, as well as the *.bib bibliographic database if used.

7.3 Journal Submission Notes

7.3.1 AIAA Journal of Guidance, Control and Dynamics

- upload the images as type “Image”. Do this before uploading the TEX file
- upload the TeX support files (.cls, .sty, etc.) as “TeX/LaTeX Suppl File”. Do this before uploading the TEX file
- Use the official AIAA style file at:
  http://mc.manuscriptcentral.com/societyimages/aiaa-j/AIAA-LaTex-Temp.zip
- When uploading files, upload everything else before the .tex file. Upload the TEX file as “Main Document”. If the .tex file is in the system, every time you upload something it will rebuild the .pdf from the .tex file. This is slow and unnecessary, especially if you have a lot of files to upload, because you can only upload 5 files at a time.
- All figures can be in pdf, png, etc. formats (despite what instructions say). The system will use PDFTEX. However, they must be in the same folder as the main TEX document.
- Entire bibliography must be in ONE file, or simply include it in the main TEX document.
- SI with a sqrt in the units field does not work with ScholarOne
- Packages subcaption and footnote do not work with ScholarOne

7.3.2 AIAA Journal of Spacecraft and Rockets

This journal is now using the ScholarOne software, a step backwards if you want to submit in TEX. In particular, you now need to upload the raw TeX source, and have ScholarOne TeX it for you into a PDF file. You’ll need to:

- use the official AIAA.cls style file
- convert any figures to *.eps files
- upload the AIAA.cls and aiaa.bst files if you want to use the *.bbl file
- or, copy the *bbl file content directly into your main document instead of invoking the BiBTEX system.
- **Most Important:** When uploading the *.eps images, be sure to select the file type to a “TeX Supplementary File” and not the “image” file type. Otherwise, the ScholarOne software will not find the image files.
- store all images in the root folder, and not in a sub-folder.

If you already have your images in PDF format, the following trick is useful to convert these into EPS form in OS X. 1) Open the PDF in TeXShop, 2) In the toolbar, hit the selection button, 3) select the entire figure using ctrl-A, and 4) go to the Preview program and use “Save Selection to File” to save as eps to desired location.

7.3.3 Elsevier (Acta Astronautica or Advances in Space Research)

This journal also requires you to upload the raw LaTeX source, and have the site compile it.

- Put all figures and the .tex file in one folder.
- All files will have to be uploaded one by one.
- PDF files are okay (as opposed to .eps) for figures.
- upload the main LaTeXfile as type “manuscript”
- upload PDF figures as “manuscript” type as well
- The bibtex file worked fine without requiring an upload of the associated .bst file.
- If you still have build errors, try including one figure at a time in the TeX source.

7.3.4 Celestial Mechanics and Dynamical Astronomy (Springer)

This journal also requires you to upload the raw LaTeX source, and have the site compile it.

- Put all figures and the .tex file in one folder.
- All files will have to be uploaded one by one.
- PDF files are okay (as opposed to .eps) for figures.
- To use the BiBTeX system, you might need to upload the BiBTeX style file *.bst as well.

8 Conclusion Section

The conclusion needs to provide *conclusions* regarding the results in this papers. Authors often just summarize here the highlights of the paper results. This is an ok start to a conclusion, but not enough. You need to also make conclusive statements, and maybe refer to future work to re-iterate of issues you are aware off, but are not part of the scope of the current paper.

For example, instead of writing:

> *Numerical simulations are shown where Lidar relative motion sensor errors are included.*

you could write:

> *The numerical simulations illustrate that the relative motion control is robust 1 meter of Lidar sensor errors. Future work will investigate the impact of time delay issues.*

9 Bibliography Section

When possible, use the appropriate bibliographic style file for the conference or journal paper format. This ensures that that the references are properly shown. It is convenient to keep all your reference in a single bibliographic database file, such as `references.bib` . When you run BiBTeX, the system will resolve any citation references using the latest database information.

Make sure that your bibliography is being properly typeset. Each reference must have all required information for a reader to be able to find this reference. List all authors in your *.bib file, and let the journal paper bibliography style file determine how to format the author names.

The current BiBTEX system doesn't have entrees for patent references. This can make it more challenging to properly reference such document. There are several work-arounds to this issue. I found that *.bib entrees such as

```
@misc{Lee:2003qa,
   Author = {Jar L. Lee and William Derbes and Jonathan D. Gordon},
   Howpublished = {US Patent 6,650,304 B2},
   Month = {Nov. 18},
   Title = {Inflatable Reflector Antenna For Space Based Radars},
   Year = {2003}}
```

seem to work well.

The most common entry types are journal and conference papers. Below are two examples of such entrees which illustrate how to add conference paper numbers, multiple authors, doi numbers, etc.

```
@article{Schaub:2007lr,
   Author = {Hanspeter Schaub and Islam I. Hussein},
   Doi = {doi:10.1109/AERO.2007.352670},
   Journal = {{IEEE} Transactions on Aerospace and Electronic Systems},
   Month = {October},
   Number = {4},
   Pages = {1675--1686},
   Title = {Stability and Reconfiguration Analysis of a Circulary
            Spinning 2-Craft Coulomb Tether},
   Volume = {46},
   Year = {2010}}

@inproceedings{Hogan:2011ff,
   Address = {Girdwood, Alaska},
   Author = {Erik Hogan and Hanspeter Schaub},
   Booktitle = {AAS/AIAA Spaceflight Mechanics Meeting},
   Month = {July 31 -- August 4},
   Note = {{P}aper AAS~11--466},
   Title = {Relative Motion Control for Two-Spacecraft Electrostatic Orbit Corrections},
   Year = {2011}}
```

Note that all authors should be listed individually using their full name, first and last name. The BiBTEX program will abbreviate the names as needed.

10 Acknowledgment

If the technical work was assisted by other persons through general discussions, or help running numerical simulations or perform experiments, it is nice to thanks such persons in the Acknowledgment section. If the work was supported through an external contract, or through a graduate fellowship, you should acknowledge such support here as well.

11 Publisher Copyright Question

When your paper is accepted by a journal, they will ask you about about transferring the copyright of this work to them so they can publish it. AIAA gives you multiple options, including the ability to retain the copyright and give AIAA a license to use this work (Option B). This option B is our preferred response.