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Introduction to LaTeX and how to start a new project in Overleaf

Professionally finished work (directly in PDF)

Abstract: This article presents basic information about what LaTeX is, as well as how it works and its purpose. Motivations for using it and how to start a text (or document) in this system are also explained. The Overleaf online editing platform is used, with information on how to start a new project and how to use the journal (Acoustics and Vibrations, A&V) sample files.

Introdução ao LaTeX e como iniciar um novo projeto no Overleaf

Resumo: Este artigo apresenta informações básicas do que é o LaTeX, bem como informações de funcionamento e o seu propósito. Motivações para usar e como começar um texto (ou trabalho) nesse sistema são também aclaradas. A plataforma online de edição Overleaf é utilizada, trazendo informações de como iniciar um novo projeto e de como usar os arquivos modelo da Revista Acústica e Vibrações (A&V).

1. Introduction

Dear authors[a], in this section we will briefly introduce you to the LaTeX document editing system. The English pronunciation would be "lah-tecks" or "lay-tecks", but in Brazil, it is often pronounced *as it is read*, i.e., just *latex* (which is being confused with *látex*, derived from the rubber tree). The full etymology can be found in the books of mathematicians Donald Knuth[b] and Leslie Lamport[c] [3], creators of the LaTeX fundamentals. Figure 1 engages the reader in a light-hearted way, presenting the graph of the effort involved vs. the complexity of the document.

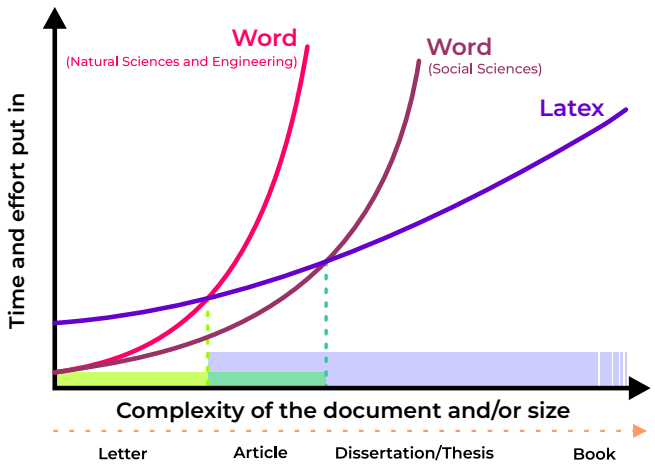

Figure 1: Estimated effort vs. complexity for the target document (Ms Word vs. LaTeX, adapted from Pinteric and Lode [4–6]).

[a] Aiming for a broader audience, this is the English version of the technical note previously published in Brazilian Portuguese [1].

[b] He is currently professor emeritus (retired) at Stanford University. He started the idea in 1977 and published the first version (of TeX) in 1982 [2].

[c] He published in 1985 the command set we know today as LaTeX (interestingly, today he works at Microsoft). In this link you can learn more historical dates and details of its evolution.

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Figure 2: LaTeX and its beautiful layout (adapted from "Something of that ilk").

In the comparison shown — Ms Word and LaTeX (in purple color) —, one can also think of two groups, Natural Sciences (in fuchsia) and Social Sciences (in burgundy), assuming that in the Social Sciences, there is no intricacy (of the same proportion) in the text regarding elements such as equations, graphs, tables, and figures.

Roughly speaking, we can say that LaTeX (the evolution of TeX) is a simplified programming language for diagramming scientific documents [7, 8]. It is widely used in the natural sciences (such as mathematics and physics) and in the various engineering communities, although many other areas also use it. This is because it is a very powerful tool for writing complex documents (involving many equations and high-resolution graphs, for example). — **But calm down, don't give up yet, read just a bit more of this article, and you will agree that it is easier when you get a ready-made *document template* from the journal (in our case).**

One can observe in the graph that for *technical texts*, from "Article" on (towards the end of the light green area, along the complexity axis), it is already worth using LaTeX, since the commitment curve for using Word for the same documentation would be higher. However, for *less technical texts*, such as those involving a Dissertation/Thesis and beyond, (near the end of the area in darker green) one concludes that learning and using LaTeX is more advantageous. As the axis of the graph deals with the term *complexity*, this is just an estimate. In the end, we mean that there is a better option for a given purpose. That is, Word (or LibreOffice equivalent) is still a great *software*, but as complexity increases, its use may become an even more difficult option than LaTeX.

Some comparative discussions point out that in writing continuous text (without other elements), the performance[1] between LaTeX and Word is similar, depending more on the typist than on skill in using the software itself. However, tables in Word are known to be easier to build[2], but in LaTeX equations[3] are simpler to format. This leads us to think that it all depends on the complexity of the document or the size it can take on (or even the amount of customization you want to do).

— So why does the LaTeX text layout look nicer? [See the funny comic in Figure 2.]
Well, as far as text is concerned, this is because of the way in which LaTeX handles text, in an *elastic mode* (user controllable), also called *kerning*, which is the flexible spacing between word characters. As far as elements such as equations, figures, tables, charts, and codes are concerned, it is very easy to arrange them throughout the text, and several types of configurations are possible.

In the "antique" computing era (MS-DOS time, or earlier), there were only *Notepad* style editors. The programming community then started developments to make it possible to write formatted text, transforming typing into *organized typing*. Thus, various types of software were born, classified as:

- those where you *write directly on the blank page*[4], as does the Microsoft Word and
- those with code layout, such as LaTeX, that need compilation to produce the final file.

[1] Considering speed and number of errors.
[2] No need to panic, there are tools *online* that help in converting tables from Word and Excel into beautiful tables for LaTeX.
[3] There are also *plugins* for Word, PowerPoint, CorelDraw, and Google Docs that allow LaTeX equations to be written within these software.
[4] Also found as WYSIWYG for *What You See Is What You Get*. There are also initiatives for WYSIWYG editors for LaTeX, trying to bring *the best of both worlds* together. For *offline*, we can mention the LyX (https://www.lyx.org), which calls itself WYSIWYM (*What You See Is What You Mean*), for *online* Overleaf itself has the *Rich text* mode which is on the same path as LyX.

— Okay, #help? Simplistically, when we edit in LaTeX, we are directly editing what is *under the paper being written*. In this analogy, Word would be the middleman, writing this command part for us (*under the paper*), whereas the end product of the two is a PDF[5] file. Figure 3 diagram demonstrates the information flows for these cases. Large publishers also edit their technical books in LaTeX, as do reputable journals such as *Journal of Sound & Vibration* and *Applied Acoustics*.

2. Writing a document in LaTeX

From an idea, or from plain text (i.e., without formatting), we start our document. If in the LaTeX system, we will continue working on the plain text. If in Word, we will already have the formatted text on the page on which we write, see Figure 4. When making a document in LaTeX, we generally use a setup with code and PDF side-by-side, as shown in Figure 4 (c).

In order to write *offline* in LaTeX, you will need to install[6] an editor (such as TexnicCenter), the toolkit that compiles the document into PDF (such as MiKTeX) and a PDF viewer (such as Sumatra PDF). Best of all, all these tools are free, that is, at no cost. For writing LaTeX *online*, we have Overleaf, which integrates all these tools in one site, without having to worry about installations or add-on's — of course, as long as you have internet access. **Overleaf**[7] is also free and without charge.

Similar to MS Word (Writer or Google Docs), Oveleaf (or TexnicCenter) has a spell-checking tool that will *correct* the document as it is written, notice the red underlines in Figure 4 (c) — this excerpt was in English and the configured dictionary was in "Portuguese (Brazil)".

— Okay, but can you help me enumerate the advantages? — Sure, let's look at some of them:

1. LaTeX is completely free and has an active development community.
2. Keeps the focus on the text and not on the formatting. After the layout is determined, it always writes in plain text (including equations).
3. Automatically updates cross-references, table of contents, lists, and bibliographic references — a big time saver.
4. Makes your own layout template with unlimited customizations.
5. Includes figures[8] and high definition vectors.
6. Has a huge number of easy-to-use elements such as equations, graphs, tables, and figures (without the program crashing).
7. Includes audio, computer code, and other types of attachments in the PDF.
8. Facilitates working cooperatively with other authors without having versioning and/or broken (or wrong) cross-referencing problems.
9. Comes with automatic cross-platform compatibility: *online*, Windows, Linux, Mac OS, and others.
10. Saves lightweight `.tex` files that reproduce identical results regardless of the compiler.
11. Uses your own bibliographic reference database, changing styles very easily.
12. Does complex equations in a simple way [9].

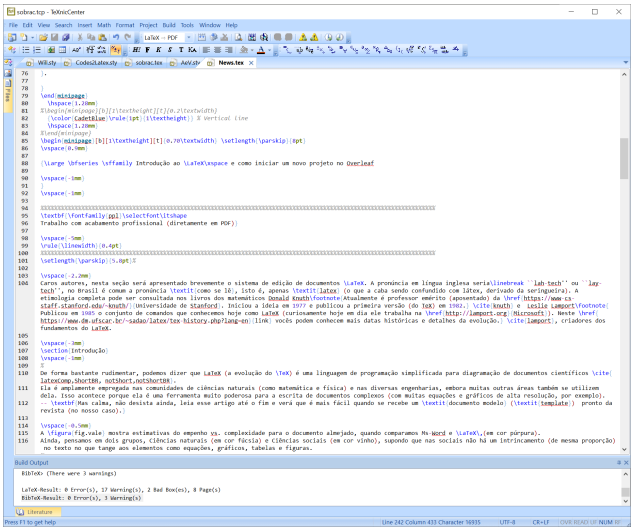
[5] Portable Document Format, a file format developed by Adobe in 1993.

[6] In this example, we are indicating tools for the Windows operating system. However, there are equivalents for both Linux and Mac OS.

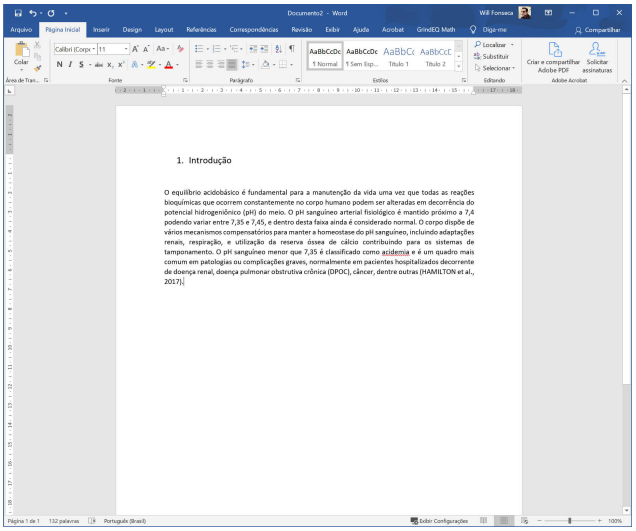
[7] There is also a paid version of Overleaf where some capabilities are expanded. However, the basic version already has everything needed to produce a complex document, such as an article, for example.

[8] *Freeware* that can be interesting for image manipulation are Inkscape and Gimp (they are analogous to the well-known CorelDraw and Adobe Photoshop, respectively). An interesting code package for exporting pictures with great quality in Matlab is export_fig.

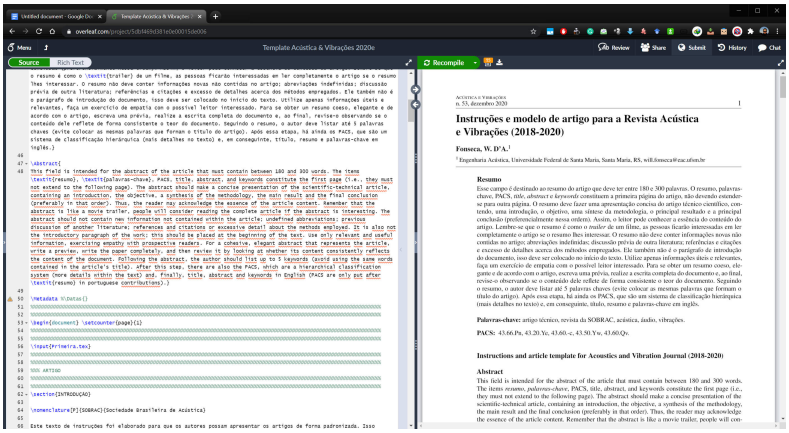
Figure 3: *Online/Offline* systems for LaTeX and WYSIWYG in comparison (workflow).



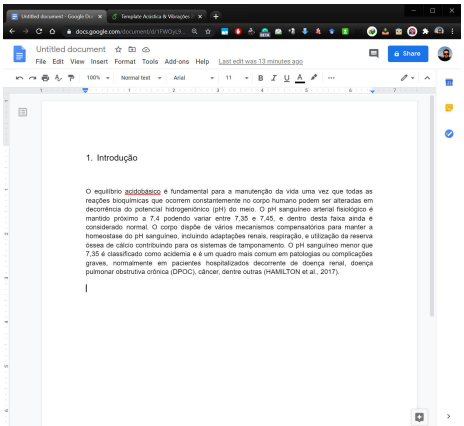
(a) TexnicCenter (LaTeX)



(b) Ms Word (WYSIWYG)



(c) Overleaf (LaTeX)



(d) Google Docs (WYSIWYG)

Figure 4: Interfaces of the options shown in Figure 3.

— Sounds cool, but do I have to learn to program a lot?

Well, that depends on your goal. Making articles for Acoustics & Vibrations Journal (*Revista Acústica & Vibrações*) is easy (!), because we offer a ready-made article template. All you need to do is to use the template's own source code as a basis and continue `Ctrl+C` and `Ctrl+V` (copying and pasting) the desired commands. To create a section, use the command `\section{Introduction}`, for example.

The A&V Journal is also finalized in LaTeX, so it has become the preferred format for constructing articles. In order to make it easier, the article template is available both on the journal website and on Overleaf. **It's worth a try!** The editorial board is always in support of our authors.

Searching on Google or in the active communities TeX StackExchange and LaTeX Community, you can find a multitude of solutions to your needs. Furthermore, there are many manuals and tutorials on the Internet, from beginners to advanced [8], including on YouTube.

Of course, there is a learning curve. One's evolution within the theme depends on effort, just as when learning any new skill. However, with the *template* in hand, it is much easier to get started and continue successfully. See Figure 5 for the functionalities related to LaTeX.

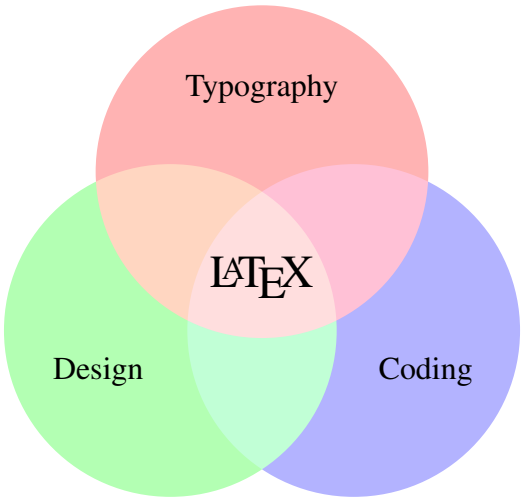


Figure 5: Diagram relating the functionalities of the LaTeX (extracted from Kottwitz [10]).

3. Working on Overleaf — Ok, let's get started?

To get started with Overleaf, simply follow these steps:

1. First create a personal account at https://www.overleaf.com, Figure 6. In this account, you can include as many projects as you like.

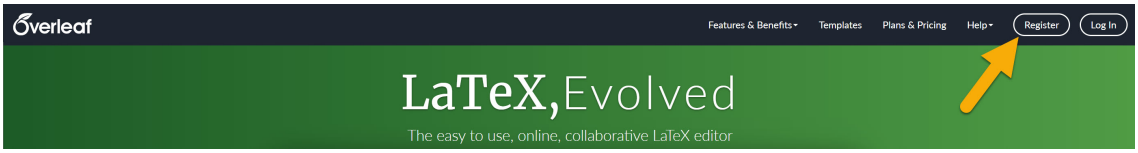


Figure 6: Open an account at Overleaf.

Inserts

2. After registration, open the template article at https://www.overleaf.com/read/mnmwhwcsykjh. Since no one can work on it directly, simply download a copy of the complete project. Go to "Menu" and click on "Source", in order to receive a `.zip` file of the whole project (see Figure 7). Returning to https://www.overleaf.com/, click on "New Project", then "Upload Project", and then just open the downloaded `.zip`. There you go (!), you are now able to write your own LaTeX article for the A&V Journal.

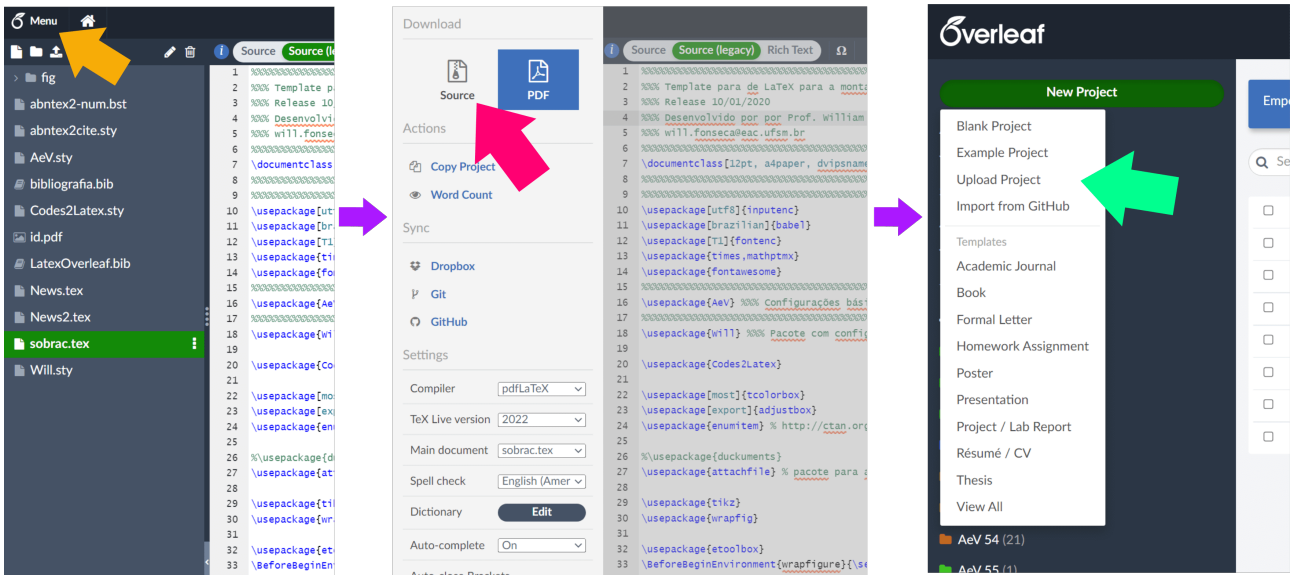


Figure 7: Downloading and uploading a project to Overleaf.

3. In your document you will notice different areas (from left to right): project files (pink arrow); programming in LaTeX (blue arrow); comments column (green arrow), and produced PDF (golden yellow arrow), see Figure 8. If you need to change the interface language, go to the bottom of the page under https://www.overleaf.com/project and choose your desired language.

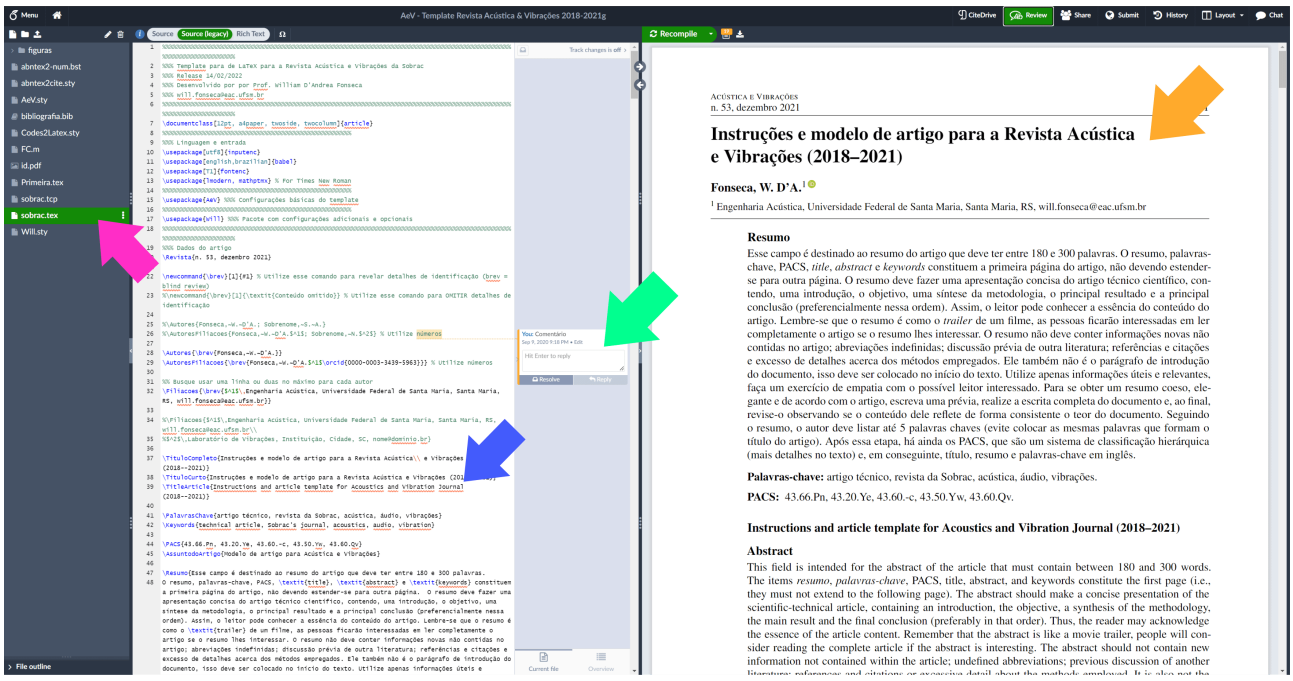


Figure 8: Traditional screen of a project in Overleaf.

4. Our main (or "master") file is named `sobrac.tex`. You can start editing your article there. The figures can be *uploaded* to the subfolder "figures", keeping your project organized. Careful, as Overleaf is case-sensitive, i.e., a file name of "House.jpg" is different from "house.jpg".

   Another important file for an author is `bibliography.bib`, which contains the list (or database) of references. We suggest you use a bibliography manager such as JabRef, Mendeley, or Zotero to edit the *offline* database and then upload the file to the project (there is also the online manager CiteDrive, which integrates with Overleaf). Always choose UTF8 encoding for the *.bib* file — it will be compatible with any *online/offline* platform. Most journal sites allow you to directly download the `.bib` of the articles (search for export or cite), avoiding the need to do everything manually. Another tip is that some browser plug-ins (BibItNow for Chrome, for example) offer the possibility to easily export several types of items to the bibliography.

   Moreover, Google Academic can help a lot too. Always check the data imported from the Internet, as eventually, something out of place will show up. Always include as much information as possible. Do not forget to call the correct `.bib` (more than one can be used) before finalizing the document `sobrac.tex` (in the References section).

5. In the upper-right corner you find interesting tools for cooperative work such as Review (by opening a central column), Share (by sending an invitation to colleagues or making the document public), History (to review changes), and Chat (to interact with authors who are online). In Overleaf Pro you can track changes by author, PDF compilation is faster, and the History capabilities are extended.

6. Above the PDF we have the following important buttons on display: Recompile (to generate a new PDF from the changed source code); the second icon (little paper with numbers), which shows errors (in red) and *warnings* (in orange); and the third icon, to download the PDF. Above those three buttons (in the dark blue bar) you find the project name, which you can adjust at any time. If you notice an error annotation, always adjust it, as it may prevent the PDF from being compiled correctly, see Figure 9.

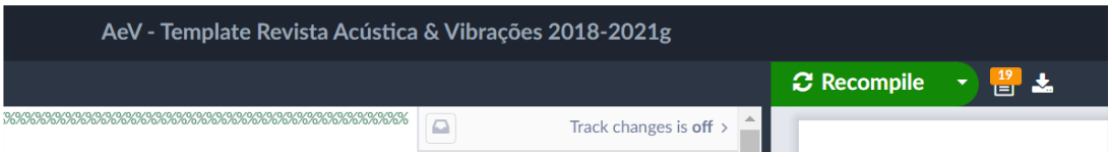


Figure 9: Options to compile, check for errors and download the PDF.

7. Under "Menu", you can find several interesting features such as synchronizing the project with GitHub or Dropbox; selecting the language for spell check; checking keyboard shortcuts; getting help from Overleaf; and others.

8. With a little curiosity, the exploration of LaTeX and Overleaf continues further and further. Overleaf's own website has several tutorial articles. At this point, we know the basics and are ready to start the article.

3.1 Editing the A&V Journal template

The journal template is meant to be straightforward and easy, so most of the settings are inside the file `AeV.sty`. Feel free to peek at the file, but there is no need to change it. We start directly in the file `sobrac.tex`, changing data from the issue number, the authors, the affiliations, the title of the article, the headline title, keywords, abstract, and PACS. With that completed, we can now move on to the article content.

Use the A&V's command `\brev{}` to omit identifying details, already considering the *double-blind* review process. There are two commands, when you want to display the content, use one of them, when you want to omit it, use the other (check the *template* itself).

The `\begin{document}` command determines the beginning of the content part of the article/document — everything prior to it is then called the preamble, where the project's specifications and functionality reside. Look for `\section{Introduction}`. From this command, we have the written article (or the *template*, in this case). To finalize, just delete the instruction content and put in your research content.

After the Acknowledgements section (near the end), we have the references section and other optional post-textual content. The command `\end{document}` then closes the document.

4. Final considerations

Folks, with this document I hope to have helped the users of LaTeX and Overleaf by providing information to help you to edit and publish your articles. What has been presented is brief in view of the wide range of possibilities. However, now you have the *initial speed* to go further.

For those who want to write their graduate papers, your university probably offers a ready-made *template* as well. If it doesn't exist, you can adapt another university's template to your need.

Finally, please consider sending your article to Acoustics and Vibrations Journal (*Revista Acústica e Vibrações*) in English, Portuguese, or Spanish language.

5. Acknowledgment

Thank you for your attention and we look forward to receiving your article.

I also want to thank the LaTeX community, who continuously develops and advances beautiful work. Furthermore, a special thanks to Joe Lacey, who polishes the English writing (of this author) so the text is sharp and bright — I do recommend him to proofread yours too.

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