UNIVERSIDADE FEDERAL DE UBERLÂNDIA

Name Surname

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Uberlândia

2022

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Final thesis for the graduation course of Aeronautical Engineering of the Universidade Federal de Uberlândia for the degree of Bachelor in Aeronautical Engineering.
Supervisor: Prof. Dr. Orientador

Uberlândia
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This final thesis has been considered suitable for obtaining the Bachelor's Degree in Aeronautical Engineering and approved in its final form by the Aeronautical Engineering Graduate Course.

Uberlândia, August 10, 2022.

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ACKNOWLEDGEMENTS

You can write your acknowledgements in english and portuguese. Check the latex syntax in the tex example file.

Express your gratitude to your advisor professor, friends, family, etc..

Voce pode escrever seus agradecimentos em ingles e portugues. Veja a sintaxe no arquivo de template.

Agradeça seu orientador, amigos, família, etc..

ABSTRACT

This thesis is amazing and it talks about amazing stuff

Keywords: Template; UFU; ABNT.

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

GNSS	Global Navigation Satellite System
VTOL	Vertical Take-Off and Landing

CONTENTS

NOTATION

In this work, scalars are presented using normal weighted characters, e.g. $\lambda \in \mathbb{R}$, vectors and matrices are denoted with bold symbols, e.g. $\boldsymbol{\nu} \in \mathbb{R}^{m \times n}$ and coordinate transformation matrices are given with the following subscript notation:

$$\boldsymbol{R}_{AB}$$

where $\boldsymbol{R}_{AB}$ represents the matrix transformation from frame B to A.

Geometric vectors are denoted with capital subscripts to indicate at which coordinate system the vector is denoted in. As an example, $\boldsymbol{V}_B$ represent a velocity vector denoted in the Body frame (B).

1 INTRODUCTION

1.1 ADDING ACRONYMS

You can add an acronym and its meaning using `\glsxtrfull{ACRONYM}` or you can add only the acronym using `\glsxtrshort{ACRONYM}`.

`\glsxtrfull{GNSS}` = GNSS (Global Navigation Satellite System)

`\glsxtrshort{GNSS}` = GNSS

Note that you must add the acronym to the tex file `"siglas_simbolos.tex"`

1.2 CITATIONS

You can cite someone using `\textcite{AUTHOR}` or `\cite{AUTHOR}`:

According to Roskam (2001) aircraft are amazing. `\textcite{AUTHOR}`

Aircraft are amazing (ROSKAM, 2001). `\cite{AUTHOR}`

1.3 FIGURES

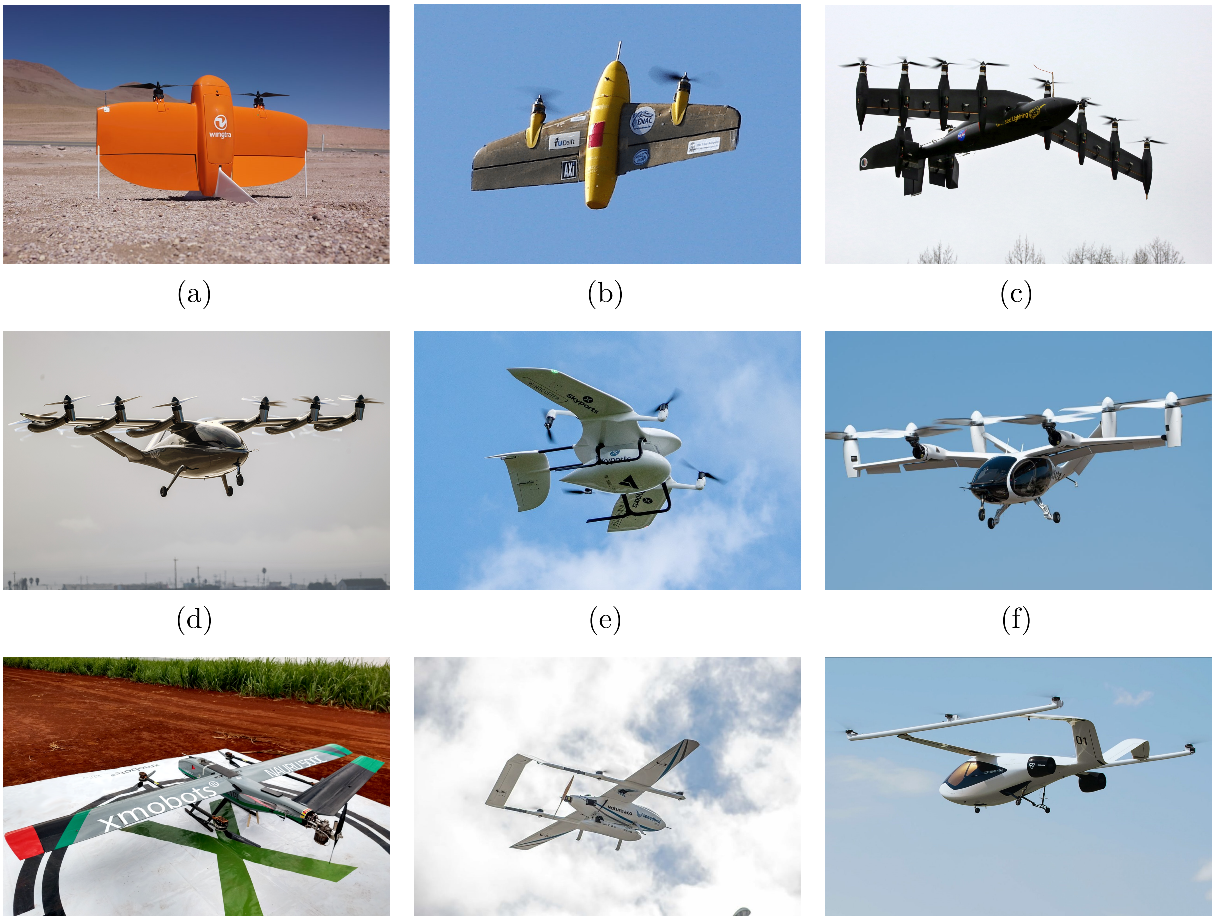
Figure 1 shows how to define subfigures and Figure 2 shows how to define a single figure. Check the tex code for more details.

To reference figures use `\autoref{FIG_LABEL}` or `\ref{FIG_LABEL}`.

`\autoref{fig:euler}` = Figure 2

`\ref{fig:euler}` = 2

Figure 1 – Different VTOL transitioning aircraft configurations. (a) and (b) perform hover flight by tilting its body, in a configuration called tailsitter. (c) utilizes a tilt-wing to align the wing and the rotors attached in the direction of the airflow for wingborne flight. (d), (e) and (f) utilize tilt-rotors to generate thrust in the forward direction for wingborne flight. (g), (h) and (i) use fixed-rotors, where different sets of motors are used for hover and wingborne flight.



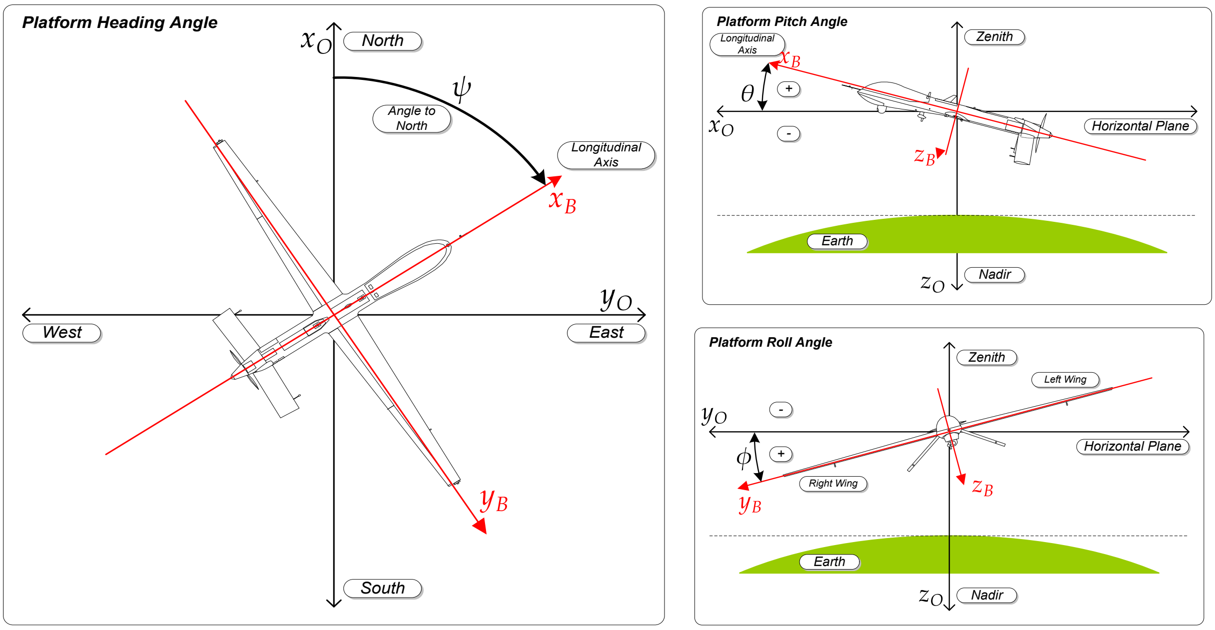
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Source: Wingtra (a), MAVLab TUDelft (b), NASA (c), Archer (d), Wingcopter (e), Joby Aviation (f), XMobots (g), Speedbird (h), Volocopter GmbH (i)

Figure 2 – Euler angles.



Source: MISB (2014).

1.4 FOOTNOTES

Use the command `\footnote{Your text goes here}`[1].

[1] And this is how it looks.

2 CHAPTER 2

2.1 EQUATION EXAMPLES

Overbrace

$$\boldsymbol{u}_{act} = [\ \overbrace{\omega_1(t) \quad \cdots \quad \omega_6(t)}^{\text{Vertical Motors}} \quad \overbrace{\omega_7(t) \qquad\quad \omega_8(t)}^{\text{Horizontal Motors}} \quad \overbrace{\delta_1(t) \quad \cdots \quad \delta_4(t)}^{\text{Control Surfaces}}\ ]^T \tag{1}$$

Equations with equality signs aligned

$$\begin{aligned}
\underbrace{R(s)_{\phi_{ref},\ \phi_{cmd}}}_{R_\phi} &= \frac{\omega_\phi^2}{s^2 + 2 \cdot \xi_\phi \cdot \omega_\phi \cdot s + \omega_\phi^2} \\
\underbrace{R(s)_{\theta_{ref},\ \theta_{cmd}}}_{R_\theta} &= \frac{\omega_\theta^2}{s^2 + 2 \cdot \xi_\theta \cdot \omega_\theta \cdot s + \omega_\theta^2} \\
\underbrace{R(s)_{\dot{\psi}_{ref},\ \dot{\psi}_{cmd}}}_{R_{\dot{\psi}}} &= \frac{\omega_{\dot{\psi}}}{s + \omega_{\dot{\psi}}}
\end{aligned} \tag{2}$$

Multiple symbols aligned

$$\begin{aligned}
\underline{\boldsymbol{u}} < \ & \boldsymbol{u}_{vtol} \ < \bar{\boldsymbol{u}} \\
\underline{\boldsymbol{u}} < \ & \boldsymbol{u}_{aero} < \bar{\boldsymbol{u}}
\end{aligned} \tag{3}$$

$$\begin{array}{ccccc}
\underline{\boldsymbol{u}} \cdot \lambda & < & \boldsymbol{u}_{vtol} \cdot \lambda & < & \bar{\boldsymbol{u}} \cdot \lambda \\
\underline{\boldsymbol{u}} \cdot (1-\lambda) & < & \boldsymbol{u}_{aero} \cdot (1-\lambda) & < & \bar{\boldsymbol{u}} \cdot (1-\lambda)
\end{array} \tag{4}$$

3 RESULTS

This chapter shows the results.

4 CONCLUSIONS

This thesis is amazing.

REFERENCES

MISB, Motion Imagery Standards Board. **MISB Standard 0601 - UAS Datalink Local Set**. [S.l.], Oct. 2014. Available from: https://upload.wikimedia.org/wikipedia/commons/1/19/MISB_Standard_0601.pdf.

ROSKAM, Jan. **Airplane Flight Dynamics and Automatic Flight Controls**. Third. [S.l.]: Design, Analysis and Research Corporation (DARcorporation), 2001. v. 1.

APPENDIX A – First Appendix

In the appendix, the equations and figures are identified using letters.

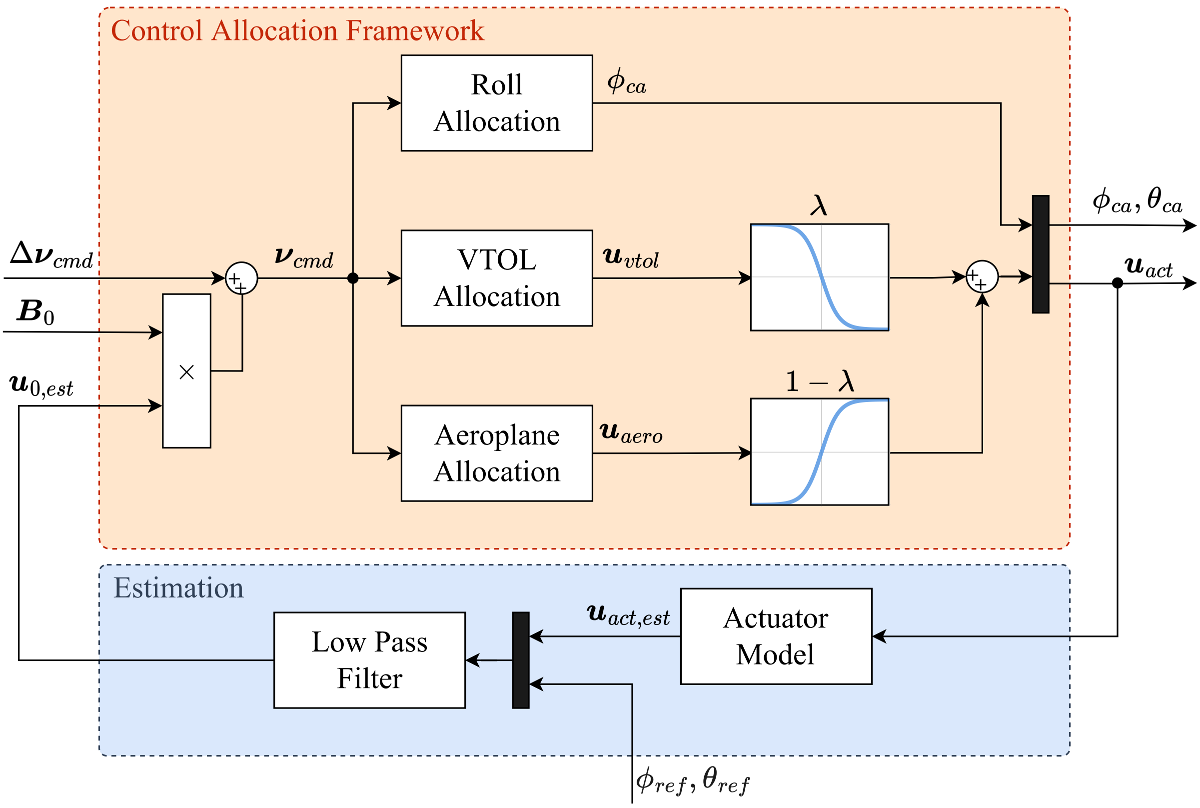
$$\boldsymbol{u}_{\mathcal{I}m}(s) + \boldsymbol{u}_{\mathcal{N}}(s) = \boldsymbol{B}_0^{-1} \cdot [\Delta\boldsymbol{\nu}(s) + \boldsymbol{B}_0 \cdot \boldsymbol{G}(s) \cdot (\boldsymbol{u}_{\mathcal{I}m}(s) + \boldsymbol{u}_{\mathcal{N}}(s))] + \Delta\boldsymbol{u}_{sat}(s)$$

$$\boldsymbol{u}_{\mathcal{I}m}(s) + \boldsymbol{u}_{\mathcal{N}}(s) = \boldsymbol{B}_0^{-1} \cdot [\Delta\boldsymbol{\nu}(s) + \boldsymbol{B}_0 \cdot \boldsymbol{G}(s) \cdot \boldsymbol{u}_{\mathcal{I}m}(s) + \cancelto{\mathbf{0}}{\boldsymbol{B}_0 \cdot \boldsymbol{G}(s) \cdot \boldsymbol{u}_{\mathcal{N}}(s)}] + \Delta\boldsymbol{u}_{sat}(s)$$

$$\boldsymbol{u}_{\mathcal{I}m}(s) + \boldsymbol{u}_{\mathcal{N}}(s) = \boldsymbol{B}_0^{-1} \cdot [\Delta\boldsymbol{\nu}(s) + \boldsymbol{B}_0 \cdot \boldsymbol{G}(s) \cdot \boldsymbol{u}_{\mathcal{I}m}(s)] + \Delta\boldsymbol{u}_{sat}(s)$$

$$\boldsymbol{u}_{\mathcal{N}}(s) = \boldsymbol{B}_0^{-1} \cdot \Delta\boldsymbol{\nu}(s) + \boldsymbol{G}(s) \cdot \boldsymbol{u}_{\mathcal{I}m}(s) + \Delta\boldsymbol{u}_{sat}(s) - \boldsymbol{u}_{\mathcal{I}m}(s) \tag{A.1}$$

Figure A.1 – Example.



Source: Author.

APPENDIX B – Second Appendix

Second Appendix

APPENDIX C – Third Appendix

Of course, you can add as many appendixes as you want. Simply follow the syntax defined in the tex files to define them correctly.