

Modeling and controlling the Mars Helicopter Ingenuity

Course of Control problems in robotics

Master's Degree in Control Engineering

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Ingenuity

1 Introduction

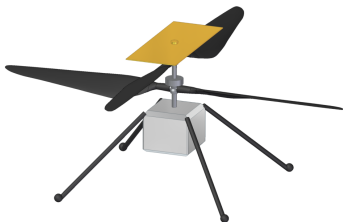


Table: Structural parameters of the Ingenuity model.

Coaxial rotor system, comprising two horizontally-overlapping counter-rotating blades to mitigate reaction torque effects.



Mars environment

1 Introduction

Compared to PowerPoint, using \LaTeX is better because:

- It is not What-You-See-Is-What-You-Get, but What-You-Mean-Is-What-You-Get: you write the content, the computer does the typesetting
- Produces a pdf: no problems with fonts, formulas, program versions
- Easier to keep consistent style, fonts, highlighting, etc.
- Math typesetting in \LaTeX is the best:

$$i\hbar\frac{\partial}{\partial t}\Psi(\mathbf{r},t) = -\frac{\hbar^2}{2m}\nabla^2\Psi(\mathbf{r},t) + V(\mathbf{r})\Psi(\mathbf{r},t)$$



Getting Started

Selecting the SINTEF Theme

To start working with `sintefbeamer`, start a \LaTeX document with the preamble:

Minimum SINTEF Beamer Document

```
\documentclass{beamer}
\usetheme{sintef}
\begin{document}
\begin{frame}{Hello, world!}
\end{frame}
\end{document}
```



Title page

1 Introduction

To set a typical title page, you call some commands in the preamble:

The Commands for the Title Page

```
\title{Sample Title}  
\subtitle{Sample subtitle}  
\author{First Author, Second Author}  
\date{\today} % Can also be (ab)used for conference name &c.
```

You can then write out the title page with `\maketitle`.

To set a **background image** use the `\titlebackground` command before `\maketitle`; its only argument is the name (or path) of a graphic file.

If you use the **starred version** `\titlebackground*`, the image will be clipped to a split view on the right side of the title slide.



Writing a Simple Slide

It's really easy!

- A typical slide has bulleted lists



Writing a Simple Slide

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- A typical slide has bulleted lists
- These can be uncovered in sequence



Writing a Simple Slide

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Code for a Page with an Itemised List

```
\begin{frame}{Writing a Simple Slide}  
  \framesubtitle{It's really easy!}  
  \begin{itemize}[<+>]  
    \item A typical slide has bulleted lists  
    \item These can be uncovered in sequence  
  \end{itemize}\end{frame}
```



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2 Mathematical model

► Introduction



Changing Slide Style

2 Mathematical model

- You can select the white or *maincolor* **slide style** in the preamble with `\themecolor{white}` (default) or `\themecolor{main}`
 - You should *not* change these within the document: Beamer does not like it
 - If you *really* must, you may have to add `\usebeamercolor[fg]{normal text}` in the slide
- You can change the **footline colour** with `\footlinecolor{color}`
 - Place the command *before* a new frame
 - There are four “official” colors:  `maincolor`,  `sintefyellow`,  `sintefgreen`,  `sintefdkgreen`
 - Default is no footline; you can restore it with `\footlinecolor{}`
 - Others may work, but no guarantees!
 - Should *not* be used with the `maincolor` theme!



Blocks

2 Mathematical model

Standard Blocks

These have a color coordinated with the footline (and grey in the blue theme)

```
\begin{block}{title}
content...
\end{block}
```

Colour Blocks

Similar to the ones on the left, but you pick the colour. Text will be white by default, but you may set it with an optional argument.









```
\begin{colorblock}[black]{sinteflightgreen}{title}
content...
\end{colorblock}
```

The “official” colours of colour blocks are:  `sinteflilla`,  `maincolor`,  `sintefdargreen`, and  `sintefyellow`.



Using Colours

2 Mathematical model

- You can use colours with the `\textcolor{<color name>}{text}` command
- The colours are defined in the `sintefcolor` package:
 - Primary colours:  `maincolor` and its sidekick  `sintefgrey`
 - Three shades of green:  `sinteflightgreen`,  `sintefgreen`,
 `sintefdarkgreen`
 - Additional colours:  `sintefyellow`,  `sintefred`,  `sinteflilla`
 - These may be shaded—see the `sintefcolor` documentation or the [SINTEF profile manual](#)
- Do *not* abuse colours: `\emph{}` is usually enough
- Use `\alert{}` to bring the focus somewhere



Using Colours

2 Mathematical model

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 - These may be shaded—see the `sintefcolor` documentation or the [SINTEF profile manual](#)
- Do *not* abuse colours: `\emph{}` is usually enough
- Use `\alert{}` to bring the focus somewhere
- If you highlight too much, you don't highlight at all!



Adding images

2 Mathematical model

Adding images works like in normal \LaTeX :

Code for Adding Images

```
\usepackage{graphicx}  
% ...  
\includegraphics[width=\textwidth]  
{assets/logo_RGB}
```





Splitting in Columns

2 Mathematical model

Splitting the page is easy and common; typically, one side has a picture and the other text:

This is the first column

And this the second

Column Code

```
\begin{columns}
  \begin{column}{0.6\textwidth}
    This is the first column
  \end{column}
  \begin{column}{0.3\textwidth}
    And this the second
  \end{column}
  % There could be more!
\end{columns}
```




Special Slides

2 Mathematical model

- Chapter slides
- Side-picture slides










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Chapter slides

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- Similar to `frames`, but with a few more options
- Opened with `\begin{chapter} [<image>] {<color>} {<title>}`
- Image is optional, colour and title are mandatory
- There are seven “official” colours:  `maincolor`,  `sintefdarkgreen`,  `sintefgreen`,  `sinteflightgreen`,  `sintefred`,  `sintefyellow`,  `sinteflilla`.
 - Strangely enough, these are *more* than the official colours for the footline.
 - It may still be a nice touch to change the footline of following slides to the same color of a chapter slide. Your choice.
- Otherwise, `chapter` behaves just like `frame`.



Side-Picture Slides

2 Mathematical model

- Opened with
`\begin{sidepic}{<image>}{<title>}`
- Otherwise, sidepic works just like frame





Fonts

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- The paramount task of fonts is being readable
- There are good ones...
 - Use serif fonts only with high-definition projectors
 - Use sans-serif fonts otherwise (or if you simply prefer them)
- ... and not so good ones:
 - Never use monospace for normal text
 - Gothic, calligraphic or weird fonts should always be avoided



Look

2 Mathematical model

- To insert a final slide with the title and final thanks, use `\backmatter`.
 - The title also appears in footlines along with the author name, you can change this text with `\footlinepayoff`
 - You can remove the title from the final slide with `\backmatter[notitle]`
- The aspect ratio defaults to 16:9, and you should not change it to 4:3 for old projectors as it is inherently impossible to perfectly convert a 16:9 presentation to 4:3 one; spacings *will* break
 - The `aspectratio` argument to the `beamer` class is overridden by the SINTEF theme
 - If you *really* know what you are doing, check the package code and look for the `geometry` class.



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Good Luck!

3 Summary

- Enough for an introduction! You should know enough by now
- If you have any suggestions or corrections, feel free to contribute on the [GitHub repository](#)! You can [open an issue](#) or [fork the project](#) and directly propose your changes with a Pull Request.



Modeling and controlling the Mars Helicopter Ingenuity

Thank you for listening!

Any questions?