# LATEX Tutorial

Duc Ngoc Minh, Dang
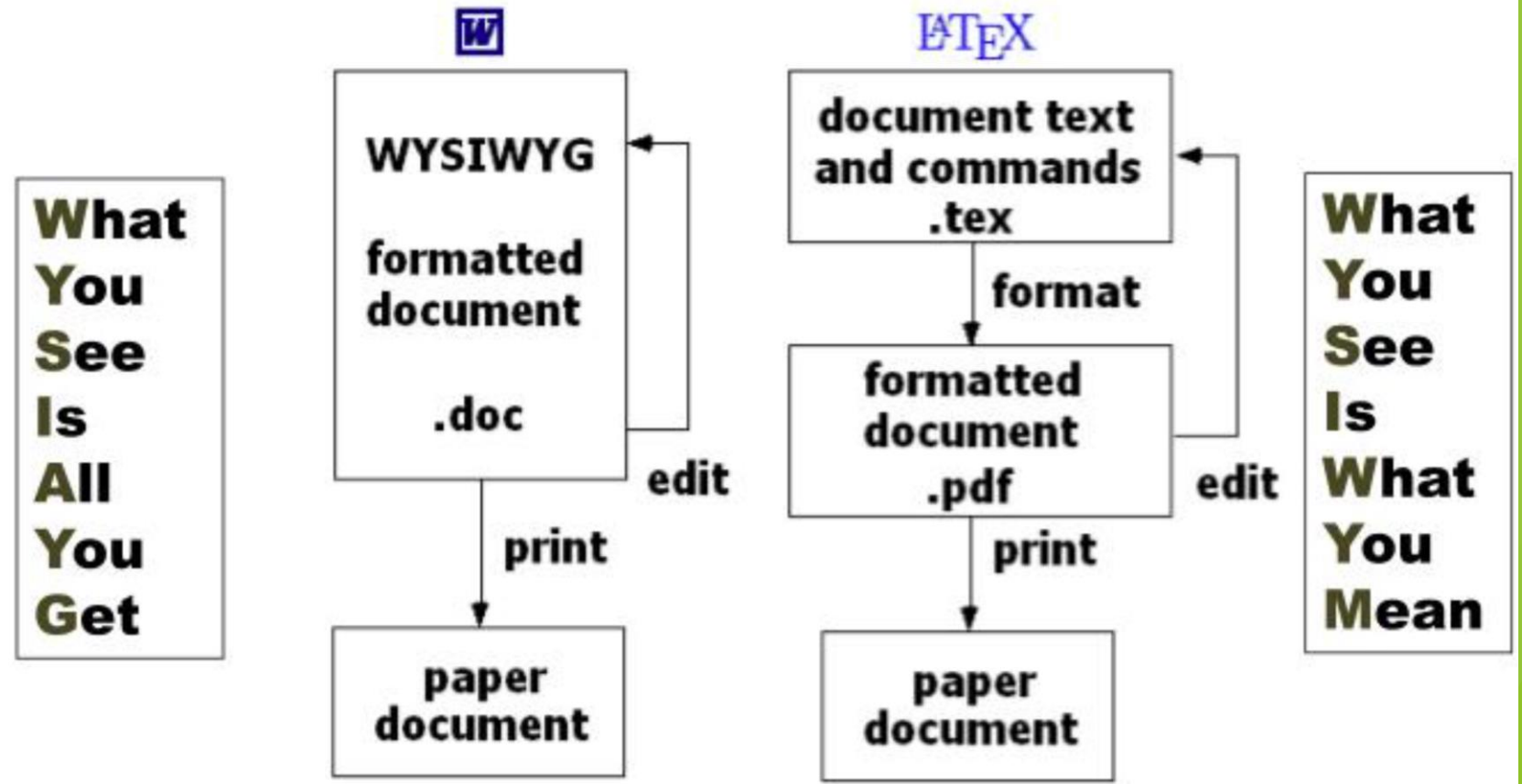
FPT University

https://dnmduc.github.io/

# Outline

- What is Latex
- Latex installation + Overleaf account registration
- Document structure/sectioning
- Color
- List structures
- Tables
- Figures
- Mathematics
- Algorithms
- Bibliography
- Presentation
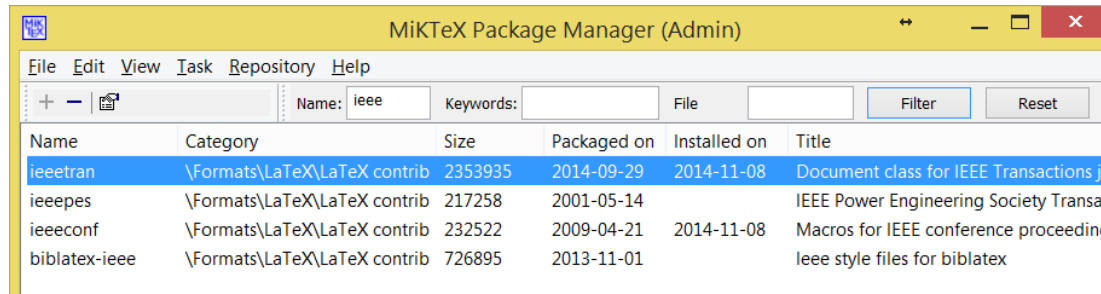- References

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# What is LaTeX?



- ▶ LaTeX is a document preparation system for high-quality typesetting.
- ▶ LaTeX is most often used to produce technical or scientific documents, but it can be used for almost any form of publishing.

# What is LaTeX?

- LATEX typesets math beautifully and much more easily than Word.

- LATEX is completely machine independent; Word is not.

- LATEX is free, Word is not.

- LATEX makes cross-references and references easier than Word.

- LATEX handles sectioning and related aspects seamlessly, Word does not.

- LATEX is backward and forward compatible, Word is not.

- If something in LATEX code goes wrong, you can post a sample in a support forum and get help. Try posting what GUI you did in Word.

- Both Word and LATEX automate some aspects of the writing process; but LATEX automates what ought to be automated, Word does all sorts of nonsense.

- A lot of people just dislike GUI based software that doesn't produce replicable code.

- In the fields where LATEX is dominant, people are often used to doing at least a little programming and those people tend to like LATEX.

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# Installation

- MiKTex 2.9: http://miktex.org/

- TexMaker: http://www.xm1math.net/texmaker/

- Install package:

  - Go to MiKTex Package Manager

  - IEEE style:

| Name | Category | Size | Packaged on | Installed on | Title |
|------|----------|------|-------------|--------------|-------|
| ieeetran | \Formats\LaTeX\LaTeX contrib | 2353935 | 2014-09-29 | 2014-11-08 | Document class for IEEE Transactions jo |
| ieeepes | \Formats\LaTeX\LaTeX contrib | 217258 | 2001-05-14 | | IEEE Power Engineering Society Transac |
| ieeeconf | \Formats\LaTeX\LaTeX contrib | 232522 | 2009-04-21 | 2014-11-08 | Macros for IEEE conference proceeding |
| biblatex-ieee | \Formats\LaTeX\LaTeX contrib | 726895 | 2013-11-01 | | Ieee style files for biblatex |

  - Vietnamese support: install vntex package

# Overleaf

▶ Register an account at: https://www.overleaf.com/



Log in to Overleaf

Log in with IEEE

Log in with Google

Log in with Twitter

Log in with ORCID

or

Email

Password
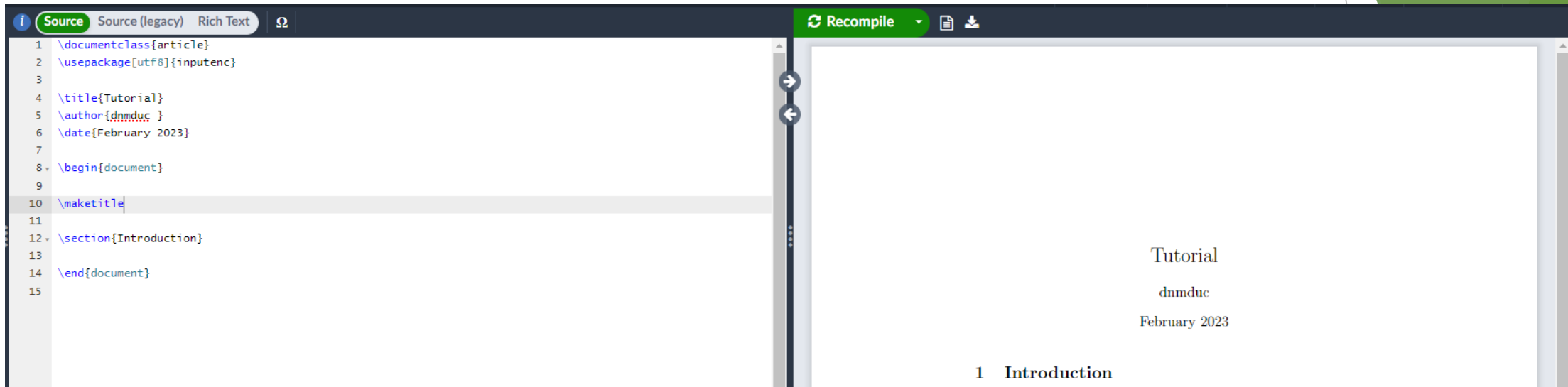
Log in with your email

# First example



▶ Click **Recompile**

▶ Check the output (.pdf file)

*Note: Reserved Characters: # $ % ^ & _ { } ~ \

→ *Use these characters in documents by adding a prefix backslash \*

\# \$ \% \^ \& \_ \{ \}

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# Document structure

\documentclass{...}

\usepakage{...}

\begin{document}

...

\end{document}

Comment: write a % symbol at the beginning of the line

Ex:

# Document Structure

▶ Template: https://www.overleaf.com/latex/templates
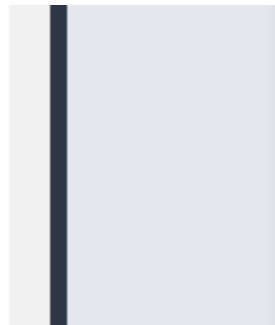
# Document sectioning

- \chapter{chapter}
- \section{section}
- \subsection{subsection}
- \subsubsection{subsubsection}
- \paragraph{paragraph}
- \subparagraph{subparagraph}

```
\section{Introduction}
\label{intro}

\section{Related works}
\label{related}

\subsection{Convolutional Neural Network}
```

1    Introduction

2    Related works

2.1    Convolutional Neural Network

# New line

- \\ (two backslashes)
- \newline
- \hfill \break

```
20
21  FPT University \\
22  Saigon Hi-tech Park \newline
23  Ho Chi Minh City campus \hfill \break
24  Vietnam
25
```

## 1   Introduction

FPT University
Saigon Hi-tech Park
Ho Chi Minh City campus
Vietnam

# New paragraph

- Blank line (empty line)
- \par

```
26  This is text contained in the first paragraph. This is
    text contained in the first paragraph.
27  This is text contained in the first paragraph.\par
28  This is text contained in the second paragraph.
29  This is text contained in the second paragraph.
30  This is text contained in the second paragraph.
31
32  This is text contained in the third paragraph. This is
    text contained in the third paragraph.
```

## 1  Introduction

This is text contained in the first paragraph. This is text contained in the first paragraph. This is text contained in the first paragraph.

This is text contained in the second paragraph. This is text contained in the second paragraph. This is text contained in the second paragraph.

This is text contained in the third paragraph. This is text contained in the third paragraph.

# Color

- \usepackage{color}
- \textcolor{declared-color}{text}
  - Ex: \textcolor{red}{This is red}
- {\color{declared-color} some text}
  - Ex: {\color{red} This is red}
- \emph{...}: *italic*
- \textbf{...}: **bold**
- {\Large some words}
- Or \tiny{This is small size}

| Command | Output |
|---|---|
| \tiny | sample text |
| \scriptsize | sample text |
| \footnotesize | sample text |
| \small | sample text |
| \normalsize | sample text |
| \large | sample text |
| \Large | sample text |
| \LARGE | sample text |
| \huge | sample text |
| \Huge | sample text |

# Labels and Cross-referencing

▶ \label{marker}  → \ref{marker}

▶ Ex: \section{Related Works}

   \label{Related_sec}

   Section \ref{Related_sec} presents …

▶ Use for referring section, equation, table, algorithm, figure, …

```
80   The Jain's fairness index
81 ▾ \begin{equation}
82       Fairnes{s_{ah}} = \frac{{{{\left( {\sum\limits_{i = 1}^n
         {{N_{ah\_s\_avg,i}}} } \right)}^2}}}{{n\sum\limits_{i = 1}^n
         {{{\left( {{N_{ah\_s\_avg,i}}} \right)}^2}} }}
83       \label{fairness}
84   \end{equation}
85
86   According to Eq. \ref{fairness} in Section \ref{intro}, the
     fairness index ...
```

## 1  Introduction

The Jain's fairness index

$$Fairness_{ah} = \frac{\left( \sum_{i=1}^{n} N_{ah\_s\_avg,i} \right)^2}{n \sum_{i=1}^{n} \left( N_{ah\_s\_avg,i} \right)^2}$$

According to Eq. 1 in Section 1, the fairness index ...

# List structures

- \begin{list_type}
  \item The first item
  \item The second item
  \item The third etc \ldots
  \end{list_type}

\begin{itemize}
 \item The first item
 \item The second item
 \item The third etc \ldots
\end{itemize}

\begin{enumerate}
 \item The first item
 \item The second item
 \item The third etc \ldots
\end{enumerate}

```
74 \begin{itemize}
75     \item The first item
76     \item The second item
77     \item The third etc \ldots
78 \end{itemize}
79
```

## 1  Introduction

- The first item

- The second item

- The third etc …

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# Tables

- \begin{tabular}{ l | c || r }
  1 & 2 & 3 \\
  4 & 5 & 6 \\
  7 & 8 & 9 \\
  \end{tabular}

- l / c / r : left / centered / right-justified column

- | / || : vertical / double vertical line

- & : column separator

- \\ : start new row

- \hline : horizontal line

- \newline : start new line within a cell

- \cline{i-j} : partial horizontal line from column $i$ to column $j$

# Tables

```latex
\begin{table}[htp]
\caption{Simulation parameters}
\centering
\begin{tabular}{| l | l | l | l |}
    \hline\hline
    Parameters & Value        & Parameters       & Value        \\
    \hline
    $N$        & 400 stations & $N_{SubRAW\_u}$  & 20 slots     \\
    Data rate  & 0.65 Mbps    & $T_{PLCP}$       & 20 $\mu s$   \\
    \hline
\end{tabular}
\label{sim_para}
\end{table}

The simulation settings is given in Table. \ref{sim_para}.
```

## 1  Introduction

Table 1: Simulation parameters

| Parameters | Value        | Parameters      | Value      |
|------------|--------------|-----------------|------------|
| $N$        | 400 stations | $N_{SubRAW\_u}$ | 20 slots   |
| Data rate  | 0.65 Mbps    | $T_{PLCP}$      | 20 $\mu s$ |

The simulation settings is given in Table. 1.

# Figures

- \usepackage{graphicx}

- \begin{figure}[htp]
    \centering
    \includegraphics[width=0.8\textwidth]{image.pdf}
    \caption{Awesome Image}
    \label{fig:awesome_image}
  \end{figure}

```
48  \begin{figure}[htp]
49      \centering
50      \includegraphics[width=1.75 in]{virtual_tc.pdf}
51      %\includegraphics[width=1.75 in]{FPTU_logo.png}
52      \caption{Virtual transmission cycle.}
53      \label{virtual_tc}
54  \end{figure}
55
56  Figure \ref{virtual_tc} illustrates the virtual
    transmission cycle...
```

## 1   Introduction
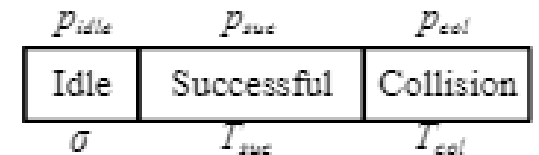


Figure 1: Virtual transmission cycle.

Figure 1 illustrates the virtual transmission cycle...

# Mathematics

- \usepackage{amsmath}  or \usepackage{mathtools}

- Greek letters: \alpha, \beta, \gamma, \Gamma, \pi, \Pi, \phi

https://oeis.org/wiki/List_of_LaTeX_mathematical_symbols

https://latexeditor.lagrida.com/

```
18  \section{Introduction}
19  \label{intro}
20
21  The equation $E=mc^2$ is discovered in 1905 by
    Albert Einstein. \\
22  The transmission probability
23  \begin{equation}
24      \tau_{e}=\left[ \frac{1-q_e}{q_e} \right]
25      \label{tau_e}
26  \end{equation}
```

## 1  Introduction

The equation $E = mc^2$ is discovered in 1905 by Albert Einstein.
The transmission probability

$$\tau_e = \left[ \frac{1 - q_e}{q_e} \right] \tag{1}$$

# Algorithms

\usepackage{algorithm}
\usepackage{algorithmic}

- \STATE <text> \IF{<condition>} \STATE{<text>} \ELSE \STATE{<text>} \ENDIF
- \FOR{<condition>} \STATE{<text>} \ENDFOR
- \FOR{<condition> \TO <condition> } \STATE{<text>} \ENDFOR
- \FORALL{<condition>} \STATE{<text>} \ENDFOR
- \WHILE{<condition>} \STATE{<text>} \ENDWHILE
- \REPEAT \STATE{<text>} \UNTIL{<condition>}
- \LOOP \STATE{<text>} \ENDLOOP
- \REQUIRE <text>
- \ENSURE <text>
- \RETURN <text>
- \COMMENT{<text>}
- \AND, \OR, \XOR, \NOT, \TO, \TRUE, \FALSE

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# Algorithms

```
33 \begin{algorithm}
34     \caption{An algorithm with caption}\label{alg:two}
35     \begin{algorithmic}
36         \STATE $i\gets 10$
37         \IF {$i\geq 5$}
38         \STATE $i\gets i-1$
39         \ELSE
40         \IF {$i\leq 3$}
41         \STATE $i\gets i+2$
42         \ENDIF
43         \ENDIF
44     \end{algorithmic}
45 \end{algorithm}
```

## 1    Simulation

**Algorithm 1** An algorithm with caption

$i \leftarrow 10$
if $i \geq 5$ then
  $i \leftarrow i - 1$
else
  if $i \leq 3$ then
    $i \leftarrow i + 2$
  end if
end if

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# Bibliography

- Create .bib file (use google scholar, ieeexplore ...)
- @article{greenwade93,

  author = "George D. Greenwade",

  title = "The {C}omprehensive {T}ex {A}rchive {N}etwork ({CTAN})",

  year = "1993",

  journal = "TUGBoat",

  volume = "14",

  number = "3",

  pages = "342--351" }

- \cite{greenwade93}

- \cite{citation01, citation02}

# Citation

| APA style | IEEE style |
|---|---|
| APA: American Psychological Association | IEEE: Institute of Electrical and Electronics Engineering |
| Used in Psychology, Economics, Nursing and Linguistic studies | Used in Engineering, Computer, Science, Information Science |

# In-text Citations: APA style

*Below is the APA citation format you have been using in this course:*

According to the National Climate Assessment, human influences are the number one cause of global warming, especially the carbon pollution we cause by burning fossil fuels and cutting down forests **(Littlewood, 2016)**. The carbon dioxide, methane, soot, and other pollutants we release into the atmosphere act like a blanket, trapping the sun's heat and causing the planet to warm. Evidence shows that 2000 to 2009 was hotter than any other decade in at least the past 1,300 years **(Ester, 2012)**. According to the National Oceanic and Atmospheric Administration, in 2015 there were 10 weather and climate disaster events in the United States that caused at least $1 billion in losses **(Smith, 2018)**. For context, each year from 1980 to 2015 averaged $5.2 billion in disasters **(Littlewood, 2016)**. If you zero in on the years between 2011 and 2015, you see an annual average cost of $10.8 billion **(Smith, 2018)**.

*On the next slide, you will see how IEEE citations are used for the same text.*

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# In-text Citations: IEEE style

According to the National Climate Assessment, human influences are the number one cause of global warming, especially the carbon pollution we cause by burning fossil fuels and cutting down forests [1]. The carbon dioxide, methane, soot, and other pollutants we release into the atmosphere act like a blanket, trapping the sun's heat and causing the planet to warm. Evidence shows that 2000 to 2009 was hotter than any other decade in at least the past 1,300 years [2]. According to the National Oceanic and Atmospheric Administration, in 2015 there were 10 weather and climate disaster events in the United States that caused at least $1 billion in losses [3]. For context, each year from 1980 to 2015 averaged $5.2 billion in disasters [1]. If you zero in on the years between 2011 and 2015, you see an annual average cost of $10.8 billion [3].

**APA Equivalent**

(Littlewood, 2016)

(Ester, 2012)

(Smith, 2018)
(Littlewood, 2016)
(Smith, 2018)

*In IEEE, citations are numbered in order of appearance.*
*When a citation is repeated, the same number is used.*

# Differences: APA and IEEE referencing

*Look at the two styles of listing sources below. How are they different?*

**APA:**

Littlewood, C.T. (2016, October 12). Who's concerned about desertification? *The New York Times*. Retrieved from http://www.nytimes.com

**IEEE:**

C.T. Littlewood, "Who's concerned about desertification?" *The New York Times*, Oct. 2016. Accessed on: Oct. 1, 2018. [Online]. Available: http://www.nytimes.com

# Reference Lists: APA VS IEEE

**APA: ordered alphabetically**

Ester, P. (2012, June 9). Global warming: The causes. *BBC News.* Retrieved from https://www.bbc.co.uk/news

Littlewood, C.T. (2016, October 12). Who's concerned about desertification? *The New York Times.* Retrieved from http://www.nytimes.com

Smith, G. (2018). The cost of global warming. *Time Magazine.* Retrieved from http://www.time.com

**IEEE: numbered / ordered according to appearance in paper**

[1] C.T. Littlewood, "Who's concerned about desertification?" *The New York Times,* Oct. 2016. Accessed on: Oct. 1, 2018. [Online]. Available: http://www.nytimes.com

[2] P. Ester, "Global warming: the causes," *BBC News,* Jan. 2012. Accessed on: Sep. 19, 2018. [Online]. Available: www.bbc.co.uk/news

[3] G. Smith, "The cost of global warming," *Times Magazine,* Feb. 2018. Accessed on: Aug. 8, 2018. [Online]. Available: www.times.com

# IEEE citation

\bibliographystyle{IEEEtran}
\bibliography{Mybib}          % *Mybib.bib file*

```
125   % Citation
126
127   The HER-MAC \cite{dang2014her} allows vehicle nodes
      to send safety messages without collision on the
      Control Channel (CCH) within their reserved time
      slots and to utilize the SCH resources during the
      control channel interval (CCHI) for the non-safety
      message transmissions. Other existing proposals
      \cite{Zhang_LWC_2019,Huang_WCSP_2020} ...
128
129   \bibliographystyle{IEEEtran}
130   \bibliography{Mybib}
131
132   %\printbibliography{}
133
134   \end{document}
```

The HER-MAC (0, ) allows vehicle nodes to send safety messages without collision on the Control Channel (CCH) within their reserved time slots and to utilize the SCH resources during the control channel interval (CCHI) for the non-safety message transmissions. Other existing proposals (0, , ) ...

## References

D. N. M. Dang, H. N. Dang, V. Nguyen, Z. Htike, and C. S. Hong, "Her-mac: A hybrid efficient and reliable mac for vehicular ad hoc networks," in *2014 IEEE 28th International Conference on Advanced Information Networking and Applications*. IEEE, 2014, pp. 186–193.

X. Zhang, X. Jiang, and M. Zhang, "A black-burst based time slot acquisition scheme for the hybrid tdma/csma multichannel mac in vanets," *IEEE Wireless Communications Letters*, vol. 8, no. 1, pp. 137–140, 2019.

L. Huang, L. Ding, L. Qian, F. Yang, and C. Zhi, "A tdma-based mac protocol with auxiliary reservation on a service channel for vanets," in *2020 International Conference on Wireless Communications and Signal Processing (WCSP)*, 2020, pp. 1088–1093.

# APA citation

- \usepackage[natbib=true,backend=biber,sorting=nyt,style=apa]{biblatex}

- \addbibresource{Mybib.bib}

- \printbibliography{}

```
\usepackage{flushend}

\usepackage[backend=biber,style=apa]{biblatex}     % APA
\addbibresource{Mybib.bib}                          % APA

The HER-MAC \parencite{dang2014her} allows vehicle nodes to send
safety messages without collision on the Control Channel (CCH) within
their reserved time slots and to utilize the SCH resources during the
control channel interval (CCHI) for the non-safety message
transmissions. Other existing proposals
\parencite{Wu_WireNet_2016,Huang_WCSP_2020} ...

\printbibliography{}                  % APA

\end{document}
```

The HER-MAC (Dang et al., 2014) allows vehicle nodes to send safety messages without collision on the Control Channel (CCH) within their reserved time slots and to utilize the SCH resources during the control channel interval (CCHI) for the non-safety message transmissions. Other existing proposals (Huang et al., 2020; Wu & Zheng, 2016) ...

## References

Dang, D. N. M., Dang, H. N., Nguyen, V., Htike, Z., & Hong, C. S. (2014). Her-mac: A hybrid efficient and reliable mac for vehicular ad hoc networks. *2014 IEEE 28th International Conference on Advanced Information Networking and Applications*, 186–193.

Huang, L., Ding, L., Qian, L., Yang, F., & Zhi, C. (2020). A tdma-based mac protocol with auxiliary reservation on a service channel for vanets. *2020 International Conference on Wireless Communications and Signal Processing (WCSP)*, 1088–1093. https://doi.org/10.1109/WCSP49889.2020.9299843

Wu, Q., & Zheng, J. (2016). Performance modeling and analysis of the adhoc mac protocol for vehicular networks. *Wireless Networks, 22*(3), 799–812. https://doi.org/10.1007/s11276-015-1000-6

# Sharing

# Presentation

- \documentclass{beamer}
  \begin{document}
      \begin{frame}{Title of your slide}
          Contents of slide
      \end{frame}
  \end{document}

# Presentation

```
\begin{frame}
    \begin{block}{Block title}
        This is a block in blue
    \end{block}
    \begin{alertblock}{Alert-block title}
        This is a block in red
    \end{alertblock}
    \begin{exampleblock}{Example-block title}
        This is a block in green
    \end{exampleblock}
\end{frame}
```



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# Presentation

- \pause: create stopping point

\begin{itemize}

\item This item first

\pause

\item This item second

\pause

\item This item third

\end{itemize}

# References

- http://miktex.org/

- http://www.xm1math.net/texmaker/

- http://en.wikibooks.org/wiki/LaTeX

- http://www.ieee.org/conferences_events/conferences/publishing/templates.html

- http://tex.stackexchange.com/

- https://www.overleaf.com

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# THANK YOU!

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