



General Advices on

**How to write a scientific and mathematical
manuscript**

Prof. Wai-Sun Don

School of Mathematical Sciences

Ocean University of China

Nov. 15, 2018



Firstly...

- ▶ Writing is a highly **personal** and **creative** art
- ▶ Everyone writes in their own style (for better or worse)
- ▶ Manuscripts are written for you to **communicate** with other people (e.g. reviewer/specialist/students), and to **comprehend** your idea (which is kept in your brain only)
- ▶ Manuscript should **arouse the reader's interest with an exciting beginning, motivate them to continue reading, and finish reading in a satisfactory way**
- ▶ Think of it like a moviegoer going to watch an Oscar winning movie, AND...
- ▶ You are going to write, direct and act in the movie all by yourself with (hopefully) an interesting story to tell



However...

- ▶ Of course, there are exceptions of the rules...when in doubt,
- ▶ follow the styles required by the Journal in the **"instructions to authors"**.

Read the instructions and examine a recent copy of the Journal



For your consideration...

- ▶ The following discussion does not necessary apply to every field of study
- ▶ This discussion is limited by my understanding of how to write a scientific paper in my own scientific fields (CFD, Numerical Analysis, Numerical PDEs,) and as an editor of a journal
- ▶ Mainly for your reference, general advice, and entertainment
- ▶ Mostly covers mistakes I see in the writing of my own students (**YOU KNOW WHO YOU ARE!**)



Outline

- Tools for typesetting paper
- Generic structure of a manuscript
 - ☐ Title Page
 - ☐ Abstract
 - ☐ Introduction
 - ☐ Methods/Results/Discussion
 - ☐ Tables and Figures
 - ☐ Conclusion
 - ☐ Acknowledgement
 - ☐ References
- Language
- Plagiarism



Tools for typesetting in English and Chinese

► Microsoft Word

- General typesetting paper and easy to use for basic linguistic writing
- Difficult to prepare and poor typesetting of mathematical formulas
- Not sure if there is an automatic numbering of citation, tables, figures and equations
- Spell check and grammar check (for English)

Tools for typesetting in English and Chinese

► Latex

- Great tools for professional typesetting mathematical formula
- Many journal styles
- Free and relatively easy to learn
- Easy/cheap Graphics User interface (WinEdit/Overleaf)
- Numbering of citations, equations, tables and figures are automatically done (what a miracle!)
- Spell checking (English)
- No grammar and sentence structures check (English)



Generic Structure of a manuscript

- ▶ Title Page
 - ▶ Abstract
 - ▶ Introduction
 - ▶ Methods/Results/Discussion
 - ▶ Conclusion
 - ▶ Acknowledgement
 - ▶ References

 - ▶ Embedded Tables and Figures in text
- 

Title Page : Title/Authors

Seventh and ninth order alternative WENO finite difference schemes for hyperbolic conservation laws

Li-Li Fang^a, Bao-Shan Wang^b, Zhen Gao^{a,*}, Wai Sun Don^a, Yinghua Wang^b

^a*School of Mathematical Sciences, Ocean University of China, Qingdao, China*

^b*College of Oceanic and Atmospheric Sciences, Ocean University of China, Qingdao, China*

- ❑ **Short and concise** title to alert reader of the main theme of the study
- ❑ List of authors and their respective institutions

Title Page : Abstract/Keywords

ARTICLE INFO

Article history:

Keywords: 7th-order, 9th-order, Alternative WENO scheme, Positivity-preserving, Hyperbolic conservation laws

ABSTRACT

For the alternative formulation of the 5th-order conservative weighted essentially non-oscillatory (AWENO) finite difference scheme [Jiang et al., SIAM J. Sci. Comput. **35** (2013)], its polynomial reconstruction procedure is applied to the conservative variables rather than the flux function. Hence, it can use arbitrary monotone fluxes which can potentially enhance the resolution and reduce dissipation of the fine scale structures while capturing shocks essentially non-oscillatory in the classical one- and two-dimensional problems. Here, we develop the generalized formulations of new smoothness indicators and improved nonlinear weights of higher order AWENO schemes (7th and 9th orders) here demonstrate their improved performance in terms of accuracy, essentially non-oscillatory, shock capturing and resolution for the shocked flow with fine scale structures.

- Informative, specific, comprehensive, accurate, short, and attractive (**Most people only read abstract!**)
- Convey the maximum information with the minimum of words
- Express the main issue(s) of the study and resolutions of the problem(s) addressed
- Should be written last

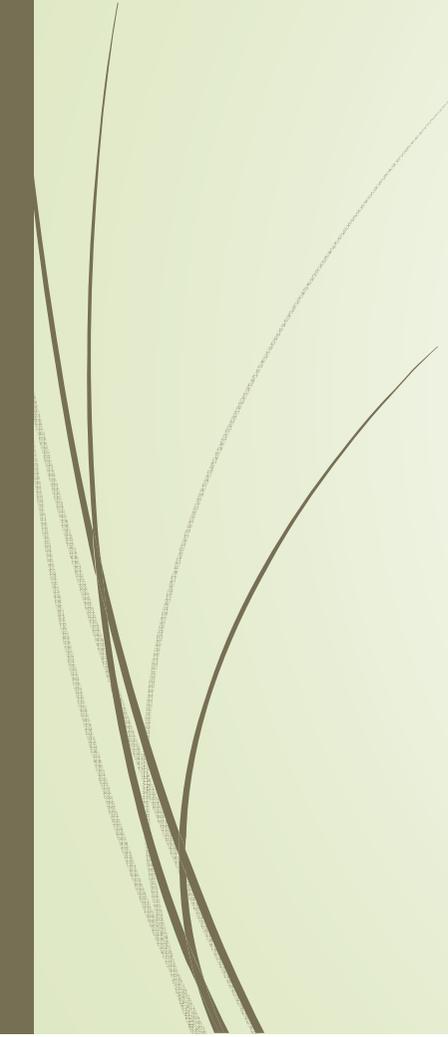


Introduction

- Introduce the reader to the subject, so that the study will be understandable even if the reader is not an expert in the field.
- Provide the necessary **motivations** (why you want to spend time on this), **background information** (what is the problem about), **aims** (what do you want to do about it) and **current state of study** (what have other people have done so far)
- Give **strong and clear** arguments for investigating the specific subject in addition to the existing literature with adequate citations.
- Convince the reviewer (most important person) and the reader of the **relevancy, timely, challenges, significance** and **broad impact** of the research



Introduction

- ▶ Provide a roadmap that indicates how you are going to tackle the challenges
 - ▶ Give the most updated references to relevant and related works
 - ▶ Should touch on the core of the subject
 - ▶ Should be concise and interesting
 - ▶ Long historical reviews of literature are dull
 - ▶ Length could be short or long depends on the depth and breath of the study.
- 

Method/Results/Discussion

- ▶ All materialistic relevant details must be presented (other than trivial/common knowledge like $1+1=2$ in the field) in a logical and easy-to-follow manner
 - it is important to reiterate the results so that the reader can follow the argument without jumping back and forth between sections/subsections
 - It is extremely important to ensure the *reproducibility* of the results
- ▶ All terms, variables, and jargon must be clearly and well defined



Method/Results/Discussion

- ▶ Structure the materials into sections/subsections logically to allow the reader to follow your argument without having to **twist their brain cells around** (This sentence is rather twistful itself!)
- ▶ Create a **logical structure** that groups related and relevant arguments together
- ▶ Give the reader a chance to transition from one idea to another between sections/subsections



Section/subsection

- ▶ Start each section with a short paragraph to give the reader a head up on what to expect in the following discussion

Numerical Example

To validate our approach in solving the hyperbolic conservation laws, we perform numerical simulation with a set of benchmark problems. They are

Example 1:

- ▶ Without the **short paragraph**, it is just plain awkward



Method/Results/Discussion

- ▶ Results must be organized logically and presented where it is needed to clarify the idea and support the argument.
Not somewhere in the middle of the paper.
- ▶ Results must be thoroughly checked for **correctness and relevance** to the study
- ▶ Only include those results that are clearly needed to support the study and, if any, note and explain any discrepancies



Method/Results/Discussion

- ▶ Describe the results in the context of the research you have conducted and related works by others.
(You want your work connect to and have impact with the wider fields beside your own little group!)
- ▶ Discuss how the results support your hypothesis with graphical aids in the form of Tables and Figures
- ▶ **DO NOT** make **wild and unsubstantiated** claims without supporting data and/or theories
(The reviewers are mostly likely to be a senior researchers in your field, and they can spot the problems easily. So, DON'T TRY IT!)



Tables

- ▶ Summarize the data collectively to present a specific idea with a minimum number of words and numbers
- ▶ Allow reader a quick pick-up of the context and results without labored reading of the text
- ▶ Provide additional information not present in the text to avoid redundancy
- ▶ Self explanatory with caption (**Avoid reference to the text if possible**)
- ▶ Designed to be simple, clear, and easy-to-follow
- ▶ Embedded closest to the text where it is mentioned

Tables

- ▶ Provide the exact numerical values up to a given significant figure.

- ▶ **Caution:**

- Instead of

3.1415926535898E-14 **3.15927**

It is quite sufficient to have

3.14E-14 **3.16**

Tables (Ugly)

Table 7. Comparison of the absolute errors and δ_N for $\alpha = 1$, different N and Example 5.6 with $\{h_{00}(t), h_{10}(t), g_{10}(s)\} = \{t^3 - t^2, \sin(t), s^2\}$ and λ_{10} .

λ_{10}	-1		0		1	
t_i	$ e_5(t_i) $ $N=5$	$ e_9(t_i) $ $N=9$	$ e_5(t_i) $ $N=5$	$ e_9(t_i) $ $N=9$	$ e_5(t_i) $ $N=5$	$ e_9(t_i) $ $N=9$
0.0	$1.11e-16$	$2.22e-16$	$2.22e-16$	0	$2.22e-16$	$6.66e-16$
0.2	$1.35e-03$	$4.91e-07$	$4.05e-03$	$5.02e-06$	$1.02e-04$	$3.71e-08$
0.4	$4.45e-03$	$1.72e-06$	$1.39e-02$	$1.79e-05$	$1.96e-04$	$3.72e-08$
0.6	$8.33e-03$	$3.40e-06$	$2.67e-02$	$3.55e-05$	$1.63e-04$	$1.08e-08$
0.8	$1.25e-02$	$5.32e-06$	$4.08e-02$	$5.53e-05$	$2.91e-05$	$1.77e-08$
1.0	$1.67e-02$	$7.30e-06$	$5.52e-02$	$7.56e-05$	$1.46e-04$	$4.61e-08$
δ_N	$1.03e-02$	$4.07e-06$	$3.36e-02$	$4.23e-05$	$1.40e-04$	$3.04e-08$

Tables (Beautiful)

Table II. The global optimal order smoothness indicator τ_{2r-1} of the $(2r-1)$ th-order WENO-Z interpolation.

r	$2r-1$	τ_{2r-1}	$\theta(\tau_{2r-1})$
2	3	$ \beta_0 - \beta_1 ^1$	3
3	5	$ \beta_0 - \beta_2 $	5
4	7	$ \beta_0 + 5\beta_1 - 5\beta_2 - \beta_3 $	7
5	9	$ \beta_0 + 4\beta_1 - 10\beta_2 + 4\beta_3 + \beta_4 $	8

Table V. L^2 and L^∞ errors computed by 7_{th} and 9_{th} orders AWENO-JS and AWENO-Z schemes with the LF and HLLC Riemann solver.

	N	LF				HLLC			
		L^2 error	Order	L^∞ error	Order	L^2 error	Order	L^∞ error	Order
AWENO-JS7	10	9.8e-4	---	1.3e-3	---	5.7e-4	---	7.9e-4	---
	20	2.2e-5	5.5	3.0e-5	5.4	1.2e-5	5.6	1.8e-5	5.5
	40	4.0e-7	5.8	7.8e-7	5.3	2.0e-7	5.9	4.3e-7	5.4
	80	8.0e-9	5.6	2.2e-8	5.1	4.1e-9	5.6	1.2e-8	5.2
AWENO-Z7	10	2.9e-4	---	3.8e-4	---	1.7e-4	---	2.3e-4	---
	20	1.0e-6	8.2	1.1e-6	8.4	4.6e-7	8.5	5.0e-7	8.8
	40	8.1e-9	6.9	8.1e-9	7.1	3.6e-9	7.0	3.6e-9	7.1
	80	6.4e-11	7.0	6.4e-11	7.0	2.9e-11	7.0	3.0e-11	6.9



Figures

- ▶ Summarize the data and provide a general trend of the data in a **VISUAL** manner
- ▶ Self explanatory with caption (**Avoid reference to the text if possible**)
- ▶ Avoid complex and confusing graphs with too much information (**Avoid information overload**)
- ▶ **Clear and clean** is the basic design goal
- ▶ Figures should be prepared with the highest possible resolution for reproduction and visual pleasure

Figures

- ▶ Use **large text**, **colored lines** (No yellow or green or pink), **line styles** and **thickness** with **legend** to avoid confusion during the reviewing stage (with a mind on printing the figures in black and white when in press)
- ▶ Figures with similar and related data should be presented in the **SAME** styles if possible (**Be consistent**)
- ▶ Place closest to the text where it is mentioned (**Do not** place the figures in a separate page at the end of the article as in some old style)
- ▶ **Do not give the reviewer a headache in trying to figure out what the story the figure is telling and reject your paper because of that.**

Figures

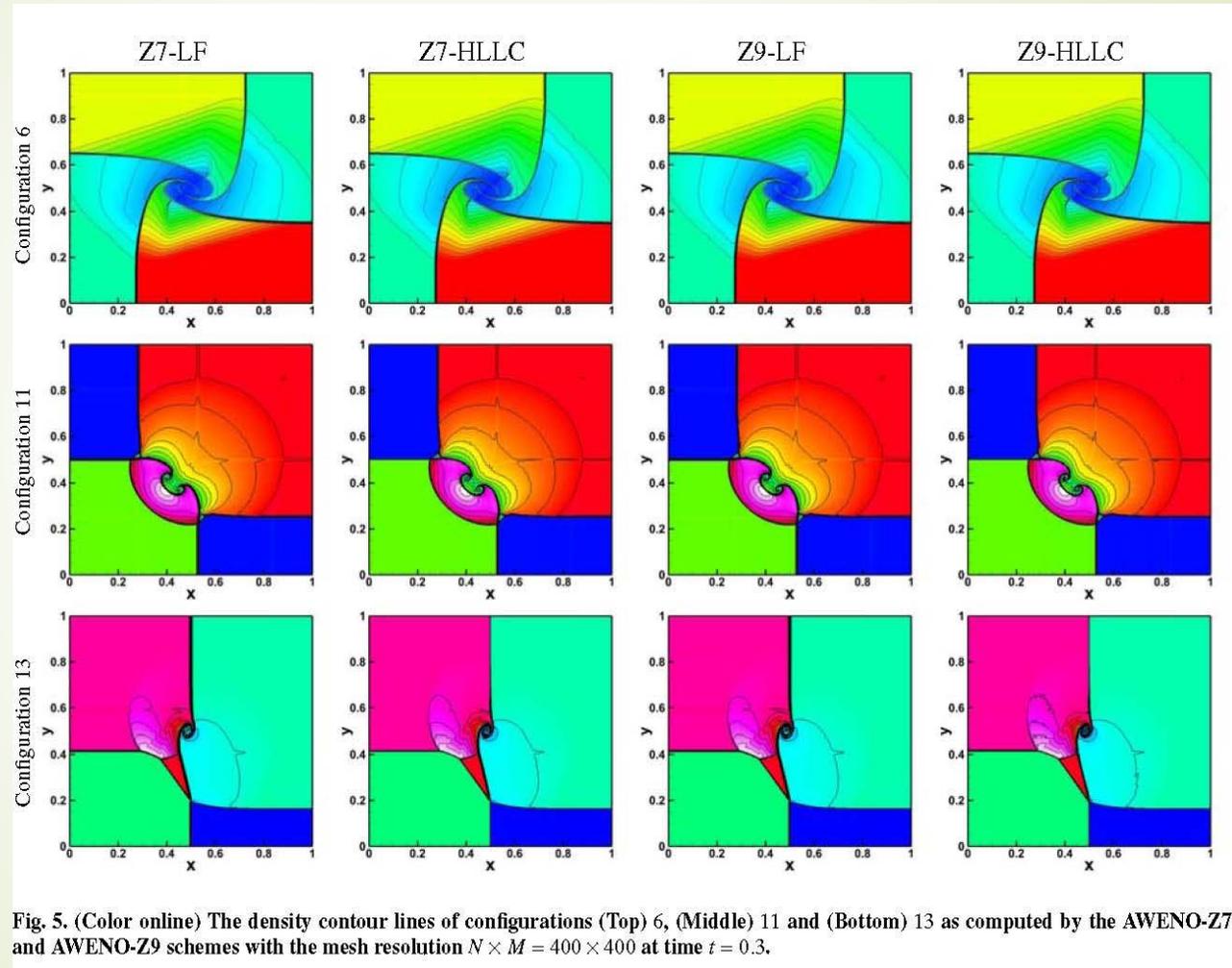


Fig. 5. (Color online) The density contour lines of configurations (Top) 6, (Middle) 11 and (Bottom) 13 as computed by the AWENO-Z7 and AWENO-Z9 schemes with the mesh resolution $N \times M = 400 \times 400$ at time $t = 0.3$.

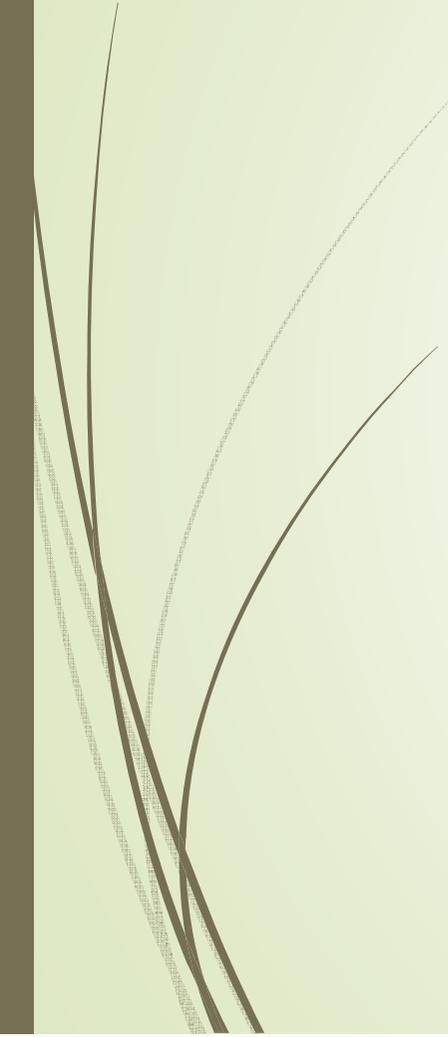


Conclusion

- ▶ A brief summary of what the study achieved and the process without going through the whole study
- ▶ Main justifications and explanations employed in reaching the conclusion
- ▶ Deficiencies of the study, if any, that would require further research
- ▶ Future and extension of the current study
- ▶ Take home message:
The reader can remember the study without knowing all the details afterward



Acknowledgements

- ▶ Give credits to the funding agencies that funded the research and organizations
 - ▶ Those have given significant advices and help, like reviewed the paper but not actively involved in the creation of the study
 - ▶ Reviewers who have helped in improving the manuscript
 - ▶ **NOT** your family members, girl/boy friends, classmates or relatives, etc.....
- 

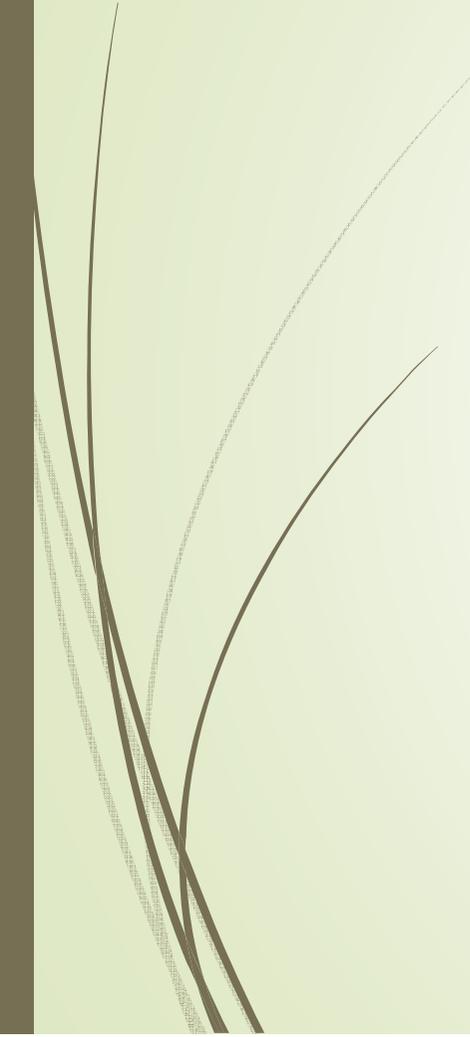


References

- ▶ Prove your knowledge of the field
- ▶ Arranged according to their **first appearance** **OR** **alphabetically** in the text and expressed in the text as numbers
- ▶ Include only relevant and scientifically-accepted articles from peer reviewed journals
- ▶ Follow the reference styles required by the Journal in the “instructions to authors”.
- ▶ Use Endnotes to help with the organization and formatting of the reference
- ▶ **Be consistent**



Reference

- [1] F. Arandiga, A. Baeza, A. M. Belda and P. Mulet, *Analysis of WENO schemes for full and global accuracy*, SIAM J. NUMER. ANAL. **49**(2) (2011) 893–915.
 - [2] D. S. Balsara and C.-W. Shu, *Monotonicity preserving weighted essentially non-oscillatory schemes with increasingly high order of accuracy*, J. Comput. Phys. **160**(2) (2000) 405–452.
 - [3] R. Borges, M. Carmona, B. Costa and W.S. Don, *An improved weighted essentially non-oscillatory scheme for hyperbolic conservation laws*, J. Comput. Phys. **227**(6) (2008) 3191–3211.
- 



Languages

- Write in **PAST TENSE** for the results of the study and/or other studies
- Write in **PRESENT TENSE** for well accepted facts, data and theories
- Write in **PASSIVE VOICE** and not in the first person

Example:

- The density of the Euler equation is computed via the WENO-Z scheme.**
- We compute the density solution using the WENO-Z scheme.

Languages

- ▶ Avoid starting sentences with “**We do**”, “**We can**”, “**We add**”, “**We change**”, etc.
(Even American students wrote a paper with almost every sentence started with “**We...**”)
- ▶ Do not start a sentence with “**This**”, “**That**”, “**They**” etc. unless it is very clear what the term are referring to.
- ▶ If for no other good reason, use **Don et al. [37]** instead of **Don and Borges [37]** in text.
- ▶ Use the word **Nine** instead of Arabic number **9** when the number is a **single digit number**.

Languages

- ▶ “Which” and “that” are interchangeable. “Which” is more formal and much stronger and it MUST BE preceded by a comma (,)
- ▶ Watch out for the Noun-Word agreement. “The schemes are...”, “The density of the seven schemes is...”
- ▶ Spell out the short abbreviation when mentioned the first time in text.
Inertial confinement fusion (ICF) is.....
- ▶ Spell checking for typos often, and mind the spacing and punctuations “><?!.,:;'()&*%\$#



Some Suggestions

- ▶ Collect data OR results of the lemmas and theorems
- ▶ Analyze the data to prepare the figures and tables
- ▶ Prepare the title page with title/keywords/authors
- ▶ Start writing the manuscript
 - ❖ **Methods** (which you know well)
 - ❖ **Results** (which you have collected)
 - ❖ **Introduction** (which you should find from literature search)
 - ❖ **Discussion** (You are on your own on this)
 - ❖ **References** (which you should already have)
 - ❖ **Abstract** (which should be written last)



More Suggestions

- ▶ Ask your friends and senior faculty for help by reading the manuscript and giving their critical comments, corrections, and questions
- ▶ Paid attention to the writing format/styles/languages usage/formula typesetting in the paper you read often (other than the scientific content) and compare that with your writing and make any necessary adjustment
- ▶ Read/**Revise**/Read/**Revise** AGAIN....
- ▶ It is an iterative process
- ▶ Practice often until you become a reasonable good writer



Plagiarism

- ▶ Plagiarism is the "wrongful appropriation" and "stealing and publication" of another author's "language, thoughts, ideas, or expressions" and the representation of them as one's own original works [WIKIPEDIA]
- ▶ Not a crime, but a copyright infringement and ethical offense in academia and industry
- ▶ It is common now that manuscripts are checked via plagiarism detection software (Turnitin, Crosscheck etc.) against existing data bases for uncovering plagiarism.
- ▶ Provide **proper citations and references** to all, except some common known facts or knowledge, of other people research, writings, and thoughts (written or spoken).



Plagiarism

- ▶ Submitting someone's work as their own.
- ▶ Taking passages from their own previous work without adding citations.
- ▶ Re-writing someone's work without properly citing sources.
- ▶ Using quotations, but not citing the source.
- ▶ Interweaving various sources together in the work without citing.
- ▶ Citing some, but not all passages that should be cited.
- ▶ Melding together cited and uncited sections of the piece.
- ▶ Providing proper citations, but fails to change the structure and wording of the borrowed ideas enough.
- ▶ Inaccurately citing the source.
- ▶ Relying too heavily on other people's work. Fails to bring original thought into the text.

"The Plagiarism Spectrum". Turnitin. Retrieved 7 August 2018.



Final Words

- ▶ Read more of literature in your field to get an idea of the proper words and often used jargons to use, the right and/or logical way to structure the arguments and general acceptance way of writing
- ▶ Compare your writing with the one in the literature and see how to improve your own writing
- ▶ Seek professional help from the English department and your faculty adviser
- ▶ It is hard to write well, but you can do it by practice writing a little at a time
- ▶ Little by little, you will get there



Final Final Words

DO NOT PISS OFF THE
REVIEWER/EDITOR
BY MAKING
NAÏVE AND STUPID MISTAKES
IN THE MANUSCRIPT
GOOD LUCK