

Session 5: Results, Discussions and Conclusion

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RESULTS



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Importance of Results

- Most critical part of the paper.
- This is the “proof”, “validation” of the hypothesis, objectives.
- **Need to benchmark your work with others.**
- Or **verify/validate** the result with an alternative method
 - experimental vs. simulation,
 - simulation vs. analytical
- To ensure your superiority are not “self-proclaimed!”



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Presenting Results

- The results MUST SHOW **certain amount of improvement** in the field of research.
 - Not sufficient to say “this is an alternative approach/solution” to the problem.
 - Note that improvement not necessary in technical terms. It can be in others aspects of the problem, e.g. cost, ergonomics, simplicity, etc.
 - **Highlight** and **detail** the improvement in strongest possible way.
- Depending on subject, results can be combined with discussion.



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Limitations in Results

- **Mention** the limitations of the result, if any
 - Do not hide
 - But do NOT excessively highlight them
 - Careful with the choice of words, not to be apologetic or self-degrading
 - Find excuses for the limitations, if you can.



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Selecting Results to be Included

- ❖ Select results that **in-line with the story line**
 - ❖ Show relevant results that support the hypothesis
 - ❖ Try to highlight the best performance
 - ❖ Avoid any errors of logic and facts
 - ❖ Good quality Figures and Tables
- ❖ Its best if **comparative work** can be shown together (Side by-side)
 - ❖ from other papers, standard documents)
 - ❖ verification using your own simulation, analysis



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Forms of Results

For effective presentation, raw data (results) need to be transformed into

- Text (Explanation)
- Graphs
- Pictures
- Oscillogram/Waveforms
- Tables

Use variety of forms,
but do not duplicate (same content presented in
different form)



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DISCUSSIONS



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Purpose of Discussion

- To interpret the meaning of results
 - giving some sense to to the data
- To relate the results with bigger picture/
concept/ideas
 - Avoiding isolation
- To compare the results with similar work
 - justifying the superiority/performance of
your work



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Steps in Writing Discussions (in order)

- ❖ Begin by stating the finding
 - ❖ It should be a direct, declarative, and brief proclamation of the results.
- ❖ Explain the meaning of the findings
 - ❖ Describe significance of the data
 - ❖ Results and their importance seem obvious to you, but not for others.
- ❖ Relate the findings to those of similar studies
- ❖ Consider alternative explanations of the findings
- ❖ Acknowledge limitation, if any



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Example

Fig. 1 indicates that by using a smaller control step-size, the steady-state oscillation is reduced by 50%. This is a significant improvement, because to date, the best achievable results is only 20% [Roland et. al, 2015]. In a practical system, this translates to a lower mechanical vibration that leads to longer shaft life-time. This large reduction is not unexpected, considering the fact that the the system is designed based on optimization of the poles and zeros. Despite the improved steady state oscillation, there is an increase in the overshoot of about 2%. However, this value has no significant effect on the overall transient performance of the system, as concluded by [Walker, 2016].



Check, how good is this Discussion?

Begin by stating the finding

Fig. 1 indicates that by using a smaller control step-size, the steady-state oscillation is reduced by 50%.

Relate the findings to those of similar studies

This is a significant improvement, because to date, the best achievable results is only 20% [Roland et. al, 2015].

Explain the meaning of the findings

In a practical system, this translates to a lower mechanical vibration that leads to longer shaft life-time.



Consider alternative explanations of the findings

This large reduction is not unexpected, considering the fact that the the system is designed based on optimization of the poles and zeros.

Acknowledge limitation, if any

Despite the improved steady state oscillation, there is an increase in the overshoot of about 2%. However, this value has no significant effect on the overall transient performance of the system, as concluded by [Walker, 2016].

Excellent discussion!



What to Avoid when Writing Discussions?

1. Statements that go beyond what the results can support.
 - ❖ Over-exaggerating
2. Unspecific expressions
 - ❖ Be specific
 - ❖ Example: Don't use "higher temperature", "at a lower rate", "highly significant". Quantitative descriptions are preferred (35°C, 0.5%, $p < 0.001$).



What to Avoid when Writing Discussions?

3. Sudden introduction of new terms or ideas
 - ❖ Stick to main ideas presented the introduction
4. Speculations
 - ❖ Allowed, but must be based on fact, rather than imagination.
 - ❖ Need extra caution, not to violate principles



Writing styles: to discuss results

- The discussions of the results begin with...
- The data highlights the need for...
- The finding of the present study suggest (indicates, reveals) that...
- The results from the study provide the evidence...
- The single-most surprising result can be seen in Fig. A ...
- Among the plausible (logical, possible) explanation for the variation in the results are ...



Referring to previous work to support your findings

The results...

- **are consistent** with [1] and suggest that...
- **are in agreement** with the data given in [2]...
- **are in accord** with the conclusions...
- **are in line** with previous researchers...
- of this study **are in keeping (is in agreement)** with the previous observation, which... further support the idea proposed in [3]...
- **agree** with the findings of other studies...
- **confirm** the relationship between...
- **match** those observed in earlier studies...
- **corroborate** the finding of others...
- **mirror** those of the previous studies that have examined...
- **support (justify, acknowledge)** previous research on the same...

Watch out the keywords in colour!!



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When results are contradicting

- What is surprising is that...
- Surprisingly, the results are found to be non-compliance...
- In contrary, the results turn out to be not as expected...
- This finding is unexpected, considering that...
- The results are somewhat surprising, despite the fact that...
- The results is not as anticipated...
- However, the observed difference between the two samples are not very significant...



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More contradictions

- The discrepancies within the data can be attributed to...
- The non-conformance between the two sets of data requires more in-depth explanation of the experiment procedures...
- The most striking results to emerge from the data is that the ...
- Interestingly, the correlation between A and B is not as expected...

CONCLUSION

Conclusions: Important Elements

- Restate the aims of the paper
- Highlight findings of the work
 - Re-enforce the originality of the work
- Highlight/Summarize the achievements.
 - Make sure they are consistent with the objectives/hypothesis.
 - Try to enhance its significance/importance
- Suggest future work (if any)



Restatement of aims

- ❖ This paper has argued that ...
- ❖ This essay has discussed the reasons for ...
- ❖ In this investigation, the aim was to assess ...
- ❖ The main goal of the current study was determine ...
- ❖ The purpose of the current study was to determine ...
- ❖ This project was undertaken to design and evaluate ...
- ❖ The present study was designed to determine the effect of ...
- ❖ The aim of this study was to investigate the effects of ...
- ❖ Returning to the question posed at the beginning of this study, it is now possible to state that ...



Some key words to be used

Key words to be used:

- develop a model for ...
- establish whether ...
- predict which ...
- assess the feasibility of ...
- assess the effects of ...
- evaluate how effective ...
- better understand the ...
- find a new method for ...
- investigate impact of ...
- determine whether ...

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Alternative way to write

The study is set out to...

- test the hypothesis that ...
- explore the influence of ...
- gain a better understanding of ...
- objectively measure and assess ...
- examine the relationship between ...
- compare the two ways of treating ...
- critically examine the ways in which ...
- evaluate a new method of measuring ...
- provide the first systematic account of ...
- understand the views and experiences of ...
- review the details the available information on ...

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Summarizing research findings

- This **study has identified** that ...
- This **research has found** that ...
- This **work indicated** that generally ...
- The **investigation has concluded** that ...
- The **enquiry has shown** that ...
- The **analysis revealed** that the ...
- These **experiments confirmed** that ...
- The second major **findings** was that ...



Summarizing research finding: alternative way of writing

- The most critical finding from this study is that ...
- The relevance of the work is clearly supported by the current findings...
- The main findings can be summarized as follow:
- From the work, the following conclusions can be made: 1)... 2)...
- In summary, the study unveils the followings:
- The following is a summary of conclusions:



Significance of the findings

- ✓ The **evidences** (results, data, observations) from this study **suggests** (indicate, imply) that...
- ✓ These findings **enhance** (improve, assist) our **understanding** (believe, hypothesis) that...
- ✓ This research is **envisaged to serve** as a base for future studies and ...
- ✓ The current findings **add to a growing** body of literature on ...
- ✓ The study **has gone some way towards** enhancing our understanding of ...
- ✓ The present study, however, **makes several noteworthy contributions** to the field of...



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Recommendations for further work: Some writing style

- ❖ This work has open up up several questions that need of further investigation. Further work needs to be done to establish whether ...
- ❖ It is recommended that further research to be undertaken in the following areas:
- ❖ Further experimental investigations are needed to estimate ...
- ❖ What is now needed is a study involving ...
- ❖ Further research might explore/investigate
- ❖ Further research in this field/regarding the role of X would be of great help in ...



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Recommendations for further work

- ❖ Further investigation into the issue need to be carried out...
- ❖ A number of possible future studies using the same experimental set up are apparent.
- ❖ As an extension to the work, It would be interesting to assess the effects of ...
- ❖ More information on the issue might reveal greater degree of accuracy on this matter.
- ❖ If the debate is to be moved forward, a better understanding of the issue needs to be developed.
- ❖ These findings provide the following insights for future research ...



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