Writing a Good Journal Paper

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Abstract – good writing skills are arguably one of the most important requirements for a successful academic career. This brief provides guidelines to help improve your writing skills for conference and journal papers, proposals and theses.

I. Introduction

Research students are often expected to learn good writing skills by observation and feedback. That is, by reading good examples from the literature and by receiving feedback on their paper drafts from their supervisor. Some students have a natural talent for good writing, but all students have the potential to write well with sufficient training.

This brief condenses some important aspects of paper writing which I have learnt whilst helping my students with their writing. It is split into three main areas : understanding the contributions, selecting figures and structuring the writing.

II. Contribution Statements and Types

A. Contribution Statements

The aim of a journal paper is to make a significant contribution to the field of knowledge. Thus before beginning the paper it is important to think about what specific contributions you will be presenting. A good idea is to put these in writing, perhaps as a list of dot points, and try to make them as clear and as concise as possible. An example of a contribution statement is shown in Table 1. This also includes a brief statement of the aims and application of the work. The application statement shows an understanding of the broader context and value of the contributions. It is sometimes helpful when developing a contribution statement to try explaining your paper to another person.

Table I. Example of Contribution Statement [1]

Aim : investigate the output power reduction of wind turbines under rapidly changing wind conditions due to their inertia preventing them operating at the optimal speed :

Key Contributions :

- analytical derivation of small-signal time constant of wind turbines, definition of natural time constant and verification by numerical simulation;
- analytical derivation of power reduction with a sinusoidal wind speed variation, and verification by numerical simulation; and
- numerical simulation of power reduction using experimentally measured wind speed records and comparison with analytical predictions.

Application : this contributions allow rapid estimation of power reduction due to inertia for a given wind speed record, and also understanding the relationship between reducing turbine inertia and improving the output power under dynamic wind conditions.

B. Contribution Types

Specific contributions can generally be classified in the following three areas :

- analytical : this deals with analysis of the general case, usually with significant simplifying assumptions. It can provide high levels of physical insight and intuitive understanding of the problem. Techniques such as the use of dimensionless parametric analysis [2] can be applied.
- simulation/numerical : simulations allow more accurate results than analytical approaches as they can include non-linear and second-order effects. The results from such simulations are often harder to generalise and provide a lesser degree of physical insight. They are useful to both verify analytical results and to explore a wider range of design variations or conditions than can be often done using experimental testing.
- experimental : experimental testing provides the final confirmation/validation of the analytical and numerical simulation results. Due to cost and time limitations experimental confirmation is often limited to a few specific cases.

An ideal journal paper would make strong contributions in all three of the above areas. In practice papers are generally strong in one area and have limited results in one or both of the others.

Some form of experimental results are generally required for validation purposes for journal papers in the areas of electrical machines and drives, and power electronics. This is because simulation tools have limited ability to take into account practical effects and so it is considered important to perform some form of experimental testing.

On the other hand, a paper which purely reports experimental results for a particular machine is likely to have less archival value than one which proposes a new modelling approach for a class of machines and verifies this with experimental test results. This is because without a model, isolated experimental results have limited applicability, while a good model can be applied to a wide range of machine designs and provide physical insight into the design trade-offs.

III. Figures and Tables

The selection and quality of the figures and tables can make the difference between a good paper and an excellent one. The following guidelines may help in the choice of figures.

A. Key Figures

Papers generally have one or two key figures which are the most important. It is useful to identify these key figures early on and ensure that all the data required for them is available and they make a clear and strong point.

For the paper described in the contribution statement in Table 1 the most important figure was one showing the correlation between the analytically predicted power loss versus the numerically calculated power loss for several simulations based on measured wind speed data.

B. Tell the Story

The second guideline is that the figures should be chosen to tell the story of the entire paper. Imagine giving a presentation explaining the paper. The figures used in such a

presentation should be the same ones as appear in the paper. It is sometimes helpful to actually put together a rough presentation about the paper and then run through it verbally to ensure that one has selected the most important pictures.

C. Hierarchical Structure

Figures should show a hierarchical or "layered" structure. For instance in a paper on condition monitoring of electrical machines, the process of analysing the measured sensor signals to determine whether a fault is present could be described using the following figures :

- graph of the sensor output signal versus time;
- frequency spectrum of sensor output showing amplitude of frequency peaks;
- graph of amplitude of frequency peaks versus fault severity;

The process of refining mineral ores is a useful analogy to the above process. An each stage, the concentration of useful information is increased until a valuable outcome is produced. A common trap for inexperienced writers is to use excessive numbers of early results, for instance in the above case this could be including ten graphs of the sensor output signal under various fault conditions.

D. Comparisons

Figures and tables can provide a useful means for comparisons :

- comparing analytical, numerical and experimental results : the more types of results that are shown in a figure, generally the more useful the figure is. Thus while experimental results are interesting, it is more valuable if they are compared against some form of prediction.
- comparing the effects of various approximations in modelling. For instance a figure may show the four predicted performance curves : 1) including saturation and stator resistance, 2) saturation only, 3) stator resistance only, and 4) neither saturation nor stator resistance. Combined with experimental data showing the actual performance this figure provides a useful study of the effects of practical factors on the performance.

E. Parametric Curves

Parametric curves provide a powerful method for describing physical phenomena by describing them using sets of dimensionless parameters. Further details are provided in [2].

IV. Structure, Flow, Conciseness and Clarity

A. Structure

At this point, the contributions and major figures will have been identified. The purpose of the paper is to provide the structure to showcase these contributions. The paper needs to:

- provide background information about the importance of the topic;
- discuss previous work in this field highlighting particularly relevant earlier contributions;
- provide sufficient background theory at an appropriate level and length for less expert readers to follow the derivation without using excessive space on well-understood material;
- provide a logical series of sections covering the major contributions; and
- concluding with a clear summary of the contributions, highlighting their application, and discussing possible future work.

B. Flow

Throughout the above structure it is important that a logical "flow" be maintained. The paper should provide a smooth, logical and coherent path to understanding the key contributions and their application. Sometimes this takes some careful re-arrangement of the order of the material to make it easiest to read.

A skill which is worth acquiring through practice is to read your work pretending you have never read it before and are not familiar with the subject. This is generally easiest by allowing a day or so to elapse since you last read the draft. As you read, watch for any flaws in the logical development of the ideas. Also try to identify extraneous material which is not necessary to the development of the contributions. Deletion of such material can require a certain ruthlessness in editing, especially if it took significant effort to create, however leaving unnecessary material in a paper will distract the reader and dilute the paper's impact.

C. Conciseness and Clarity

Good writing is concise and clear. It is not difficult to recognize but takes practice to produce.

Good writing comes from a deep understanding of the concepts. It involves being able to clearly state what may be complex concepts using simple words. In some ways crafting a good sentence can be like a work of art, requiring a number of drafts and careful editing to achieve an excellent result.

One of the best parts about papers is that they generally have strict page limits. The process of condensing a much longer draft into the page limit encourages better writing.

V. Conclusion

This brief provided some guidelines to help you write better journal papers. Writing, like any skill, improves with practice and hence the best way to improve your writing is to keep on practising!

VI. References

[1] C. Tang, M. Pathmanathan, W.L. Soong and N. Ertugrul, "Effects of Inertia on Dynamic Performance of Wind Turbines," Australasian Universities Power Engineering Conference, AUPEC, Sydney 2008.

[2] W.L. Soong, "Parametric Analysis in Power Engineering," PEBN #11, Nov. 2008. See http://www.eleceng.adelaide.edu.au/research/power/pebn/

A Word for Today

God means what he says. What he says goes. His powerful Word is sharp as a surgeon's scalpel, cutting through everything, whether doubt or defence, laying us open to listen and obey. Nothing and no one is impervious to God's Word. We can't get away from it—no matter what. Hebrews 4:12-13 (The Message)