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# Writing a Research Paper

## Tips and Reflections



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## Overview

- A little on the etiquette of paper writing
- Not included: writing style
  - Learn by reading and doing
- Publishing process

## What is a contribution?

- "Here's an idea X and what you might do with it"
  - NO – that's just speculation
- "Here's my idea X. It works!"
  - Weak – only a point result, with little insight
- "Here's idea X. It's better than Y if Z holds true."
  - YES – objective evaluation
- "Here's a new study in the use of idea X."
  - OK provided genuine new insight – or 'surprise'

ie does not need to be new.



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## Why publish it?

- Objective review
- Publicity
- Credibility
- De-risk your viva
- Scholarship
- Academic brownie points

## On Recycling

- Every contribution gets at most four days out
  - Conference
  - Journal
  - Thesis
  - Book
- Every conference paper you write must have a ***unique*** contribution
  - Same for every journal paper





## Timescales

- Writing is easy if you know what you want to say
  - You've done the research and got ***all*** the results to support your contribution ➔ paper done in days
  - Deadline's in two months: you start writing now while finishing simulations ➔ might never submit

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## What should a paper look like?

- Abstract + Intro – text
- Problem – math + text
- Contribution
  - Equations
  - Tables
  - Figures
  - Discussions
- Conclusions + Refs

why should the reader care? etc.

≃ 4 pages.



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## What should a paper look like?

- Wrong proportions ➔ reader not happy

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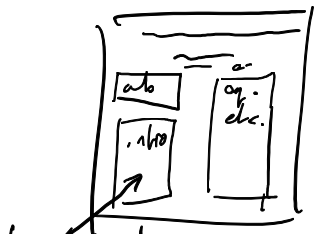
## Introduction

- What are you doing?
- Why does it need doing?
- Why is it hard to do? — important!
- Why is this new?
- ***Should be roughly the first page***






↳ intro + related work should fit on 1st page! Should also contain LOADS of citations

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## Introduction – Literature Review

- Introduction should ***include*** paragraph relating contribution to the context of the field
  - Some like a second page of "Related work"
    ➔ too much bread for my taste
- Citations ***must not stop*** here
  - Links make your work stronger
  - Beware being the (re-)inventor from scratch

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## Literature Review

- "Smith did X. Johnson did Y. Schmidt did Z."
  - NO – listing others does not make relations clear
- "Smith did it but slowly. Johnson's method needed too much power. Schmidt's way wasn't robust."
  - NO – but very common – the "I'm better because" review
  - When those authors review your paper, they'll point out the strengths of their approaches



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## Literature Review

- "Smith's wheels were larger than mine. Johnson used Linux but mine runs on Windows. Schmidt's robot was green."
  - NO – those are trivial – did you actually make a contribution?
- "Like Smith, we use round wheels. Our method is better suited to off-road terrain, whereas Smith focussed on roads."
  - YES – objective, constructive, and *not obnoxious*

## Literature Review

- Key points
  - Not better, just different
  - Every project has slightly different drivers
  - Don't be obnoxious about others' work





## Writing your paper

- The purpose of a paper is to be ***read***
  - not to ***be written***
- The best way to improve your paper is to ***read it***
  1. Bash out a draft – ***ban the backspace;*** use placeholders
  2. Go away and do something else
  3. Read it ***whole*** and note changes to be made
  4. Update draft; go to 2.

## Summary

- First, make your contribution
  - Publishing must be driven by the research
- Make sure your paper is well-proportioned
- Make lots of constructive links to other work
- Don't just write: draft, read and edit





# Conference Publishing

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## Why do conferences happen?

- Scholarship
- Networking
- Subsidized holidays for delegates
- Brownie points for organizers
- Financial gain of organizers

➔ **Choose the right conference**



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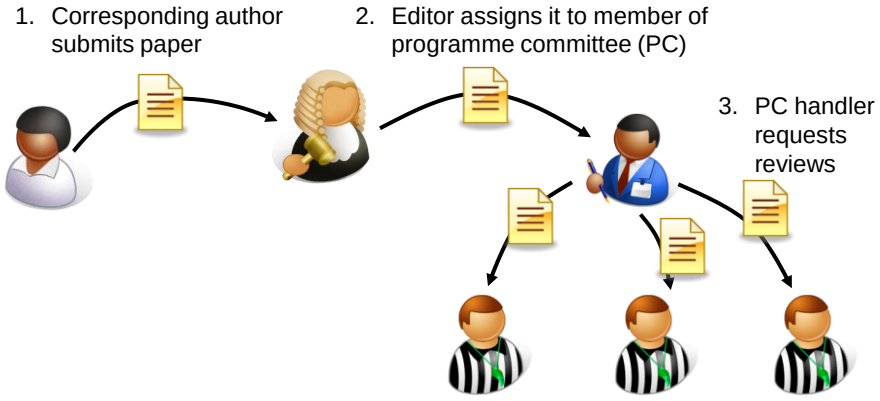
## Conference Process



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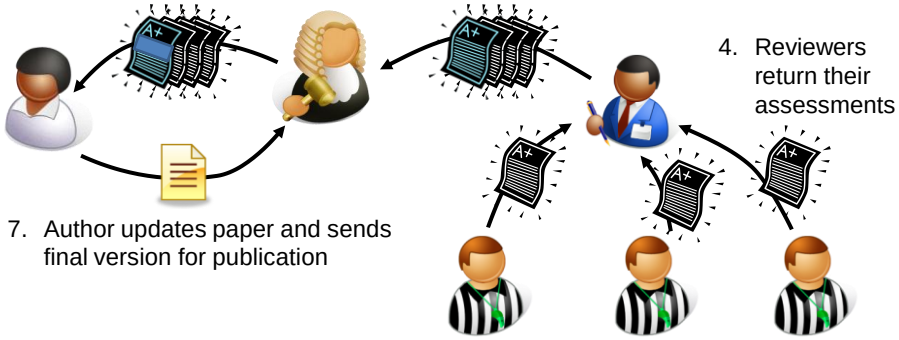
## Conference Process

6. Editor makes decision and sends anonymized reviews and PC report back to author

5. PC handler makes recommendation to editor



4. Reviewers return their assessments

7. Author updates paper and sends final version for publication



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## Conference Process

- Possible outcomes:
  - Accept
  - Accept as poster or brief paper
  - Reject
- Typically you ***must*** attend and present
  - "No paper, no podium," and *vice versa*

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## Conference Process

- Good conferences will want full length drafts
  - Weaker conferences ask for as little as a paragraph
- Good conferences will use three or more reviews
  - …and you'll get to see them
  - Weaker conferences will use fewer, shorter reviews
- Turnaround: 4 weeks (poor) – 6 months (good)



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## Reviews

- Doesn't have to be kind:
  - Does have to be constructive
- Typical structure
  - Quick summary of paper for PC
  - High level feedback
  - Overall evaluation
  - Detailed points – e.g. typos
  - References, if needed

## Not so good reviews

- "This has been done before."
  - OK, but where?
- "What if you did X?"
  - Not reviewer's job to re-do the work
- "Good paper"
  - Nice to get but hardly constructive





## Journal Publishing

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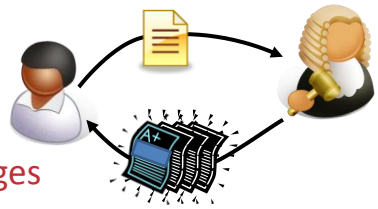
## Journal Process

- Starts off same as before
- Possible outcomes:
  a) Accept 'as is' (rare)
  b) Accept with minor changes
  c) Accept with major changes
  d) Reject

1. Corresponding author submits paper



2. Editor returns reviews (via AE and reviewers as before)



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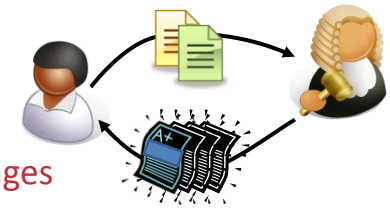
## Journal Process

- Second round
- Same outcomes:
  a) Accept 'as is' (rare)
  b) Accept with minor changes
  c) Accept with major changes
  d) Reject

*Assuming b or c:*

3. Corresponding author submits updated paper ***and*** response to reviews



4. *For case b:* Editor returns decision from AE
   *For case c:* Editor returns new reviews and decision

## Journal Process

- Associate Editor (AE) will make decision on whether second round needs fresh reviews
- Rare to go round more than twice
  - "Reviewer fatigue" – editor will reject if no decision
- Final stage: submit source and review proofs





## Responding to Reviews

- Line by line responses
  - Everything must be covered
  - Either "respectfully disagree" or "accept this suggestion" with "made a change to Section XX"
- Engage positively
  - If reviewer didn't get it, that's the *author's* problem
  - "have clarified section YY to remove misunderstanding"
- Don't argue in the response – put it in the paper

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Ms. Ref. No.: EJCON-D-13-00193

Title: Fast Model Predictive Control with Soft Constraints

European Journal of Control

**Response to Reviews**

Arthur Richards, August 2014

> *Editor: Two reviews have been received for the paper and both reviewers agree on the novel contribution by the authors. The referees have provided a number of comments which could be taken into account by the authors in the (minor) revision of the paper. In particular, the authors should address the comparison of the proposed approach with other techniques. In the revision, please indicate the changes in different colour and address each reviewer's comments in the reply letter.*

My thanks to the reviewers for their constructive comments, which are addressed in detail below. Comparison with CVXGEN, a state-of-the-art code-generation tool for convex optimization, is now included in the paper. The revised submission highlights in blue text all changes with respect to the first submitted manuscript.

> *Reviewer #1: The author describes a modification to the log-barrier method for solving quadratic programs arising in predictive control that enables modelling of soft constraints. The usual solution method for such problems involves the introduction of additional slack variables to soften the problem constraints. The author instead avoids these additional variables by introducing a barrier-like function that approximates a piecewise linear component in the objective function. The resulting problems have structure broadly similar to those developed for the log-barrier method, i.e. broadly similar to the results of [8] for hard-constrained problems. Such structure is known to have favorable properties for computation.*
>
> *The presentation of the paper is clear and well-written, and to the best of my knowledge the idea is novel. The derivations of the paper all appear to be correct, and the author is careful to describe the similarities and differences between the proposed method and related work, particularly [8,15].*
>
> *My main criticism of the paper is that it is hard to gauge the efficacy of the proposed method based on the very limited numerical results that have been presented. In particular, I would have liked to have seen more detail in two areas:*
>
> *1) the method is only applied to a single example system. It would be very beneficial to the reader to see results for a range of problems of various sizes. For example, the author could apply the proposed technique to the spring-mass system tested in [8] for systems of varying numbers of masses. It is very difficult at present to judge how the complexity, in particular the number of required iterations, will scale with problem size. This is of particular concern given the remarks of section 4.2.*

Section 5.3 of the revised manuscript includes a new example, derived from the six mass example in [8] as the reviewer suggested. This has also been solved using CVXGEN, to address the reviewer's point (2). In developing the latter example, CVXGEN was found to have problem size limitations that precluded the original example in [8] to be solved in its full form. Therefore a cut-down four mass example has been developed that can be solved by both CVXGEN and the proposed new method.

> *2) It would be nice to see a direct performance comparison with a modern interior point solver applied to the slack-variable version of the problem described in the paper. Several such solvers are freely available from groups at ETH, Leuven, Magdeburg, Stanford and elsewhere. By 'performance' I do not necessarily mean total computation time, since the solve time is strongly dependent on the details of the implementation. However, even just a count on the required number of iterations to convergence would be useful, since the per-iteration computational cost is probably the same using the author's method and an IP method, even with slightly different variable counts.*

The revised manuscript includes comparison with CVXGEN, a code generation tool for convex optimization developed at Stanford. This replaces the comparison with "quadprog" in the point mass example, Section 5.1, and is also compared for the new four mass example. Comparison of iteration counts are now provided for both examples, in the new Figure 5 for the single point mass example and in Figure 9 for the new four mass example.

> *Reviewer #2: The paper is very well written, easy to follow and appears to be mathematically rigorous. The contribution of the paper is sufficient and should be of interest to a large audience.*
>
> *The contribution of the paper is a new method to solve soft-constrained MPC problems without needing to introduce additional slack variables into the QP. The advantage of the new method is that the KKT system at each iteration of an interior point method remains banded, provided the decision variables in the QP are ordered appropriately. The paper contains numerical results to support the efficacy of the method in comparison with the 'standard' slack variable formulation.*
>
> *Though the method reduces the number of decision variables, the method might introduce problems in terms of having to work out at what rate to increase the weight associated with the so-called KS function. This could potentially introduce an additional source of numerical error, but the paper does discuss this in some detail.*

The new four mass example in Section 5.3 includes details of parameter re-tuning for a larger problem.

> *Perhaps the main open question, which I would have liked to have seen discussed, is whether the KKT system that results from the standard slack-variable formulation can be solved in a more efficient manner than just blindly including the slack variables into the QP decision variables z. Because of the special structure that arises in a soft-constrained problem, the question is whether it might be possible to eliminate the search direction \Delta s for the slack variables from the KKT system in a*