

Robotics Research Preparation

Introduction

Research Reading

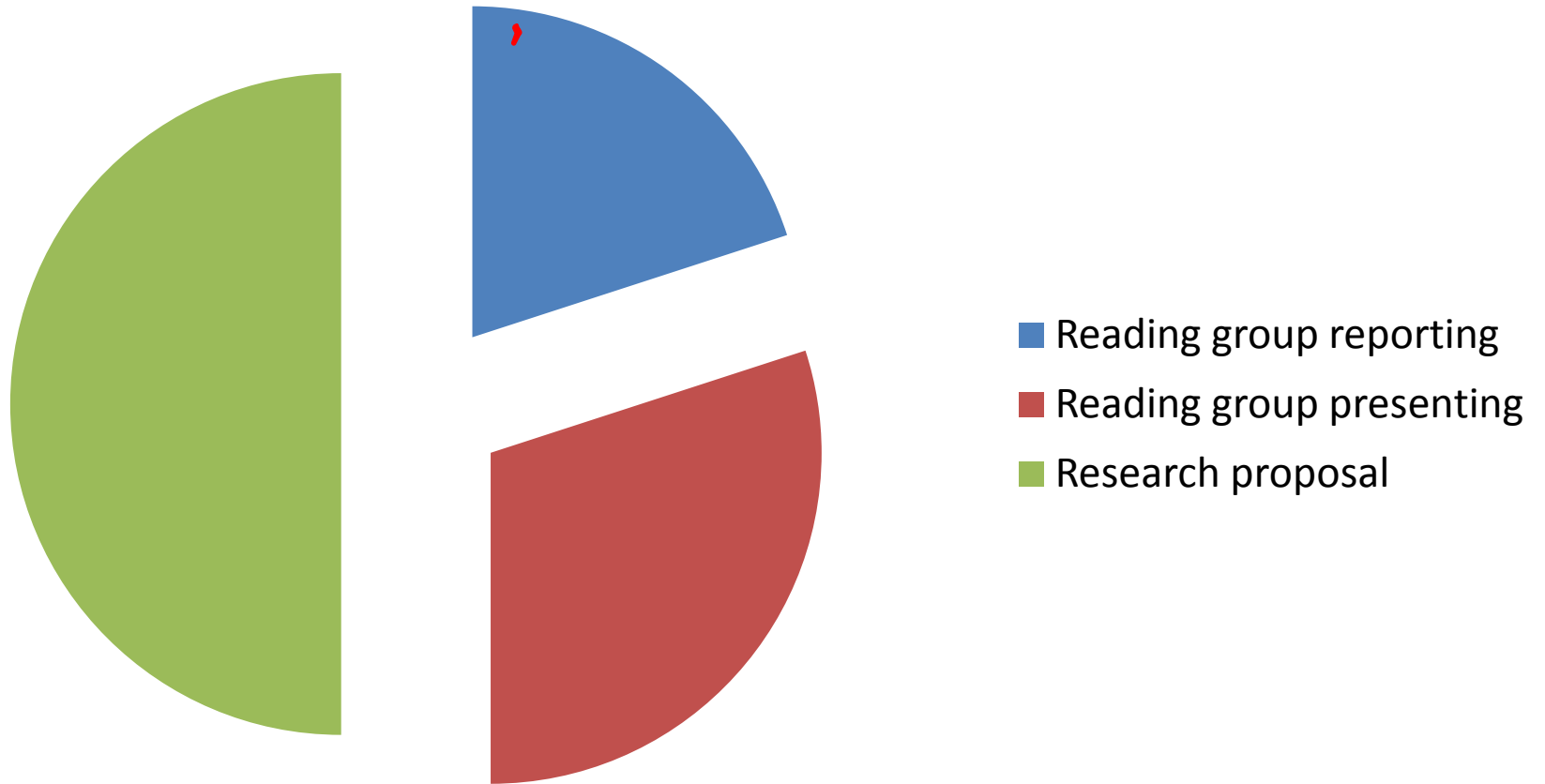
Unit Content

- Research methods lectures
 - Presenting • Reading • Software control
 - Planning & risk • LaTeX • Videos • Publishing
- Reading group
 - Weekly in small groups
 - Everyone reads and reports
 - Take turns to present and discuss

Assessment

- 20% reporting of reading
 - Captured in online wiki
- 30% presenting to the group
- 50% research proposal
 - Early TB2, using new skills to plan your project

Assessment



Reading Group

- Here to keep us all honest and in good habits
- Every week:
 - Everyone reads one paper and reviews it on the wiki
 - Each week will target certain types of paper
 - Randomly chosen individuals will present for 10mins
Will know beforehand if i'm presenting
- Everything on UoB Blackboard
 - www.ole.bris.ac.uk

Reading Group Timings 2015-16

- Teaching Block 1

- CDT students: Tuesdays 10am QB 1.82
- MSc group X: Wednesdays 12pm BRL OT12
- MSc group Y: Fridays 12pm BRL OT12

} This
has
changed.

- Teaching Block 2

- To be confirmed

Ecclesiastes 1:9

“The thing that hath been, it is that which shall be;
and that which is done is that which shall be done:
and there is no new thing under the sun.”

Edmund Burke

“People will not look forward to posterity, who never look backward to their ancestors.”

Reflections on the Revolutions in France (1790)

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Academia

- We are all part of a global community engaged in the pursuit of knowledge
 - Free transmission and publication is part of that community
 - Reading is an essential but *easily neglected* part of academic life
 - Modern academics are more frequently rated by how much they *write*

Why read?

- “My Extended Kalman Filter diverges for $n > 7$ ”
- “I think machine learning might fix my system”
- “I’ve improved my gripper – is it new?”
- “I want to learn about feet”
- “What’s new in computer vision?”

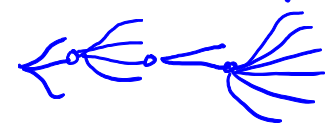
What to read?

- Conference papers *Often very new; could be refuted later.*
 - Short and sweet, focussed on a new development
- Journal papers *→ slightly higher quality (generally)*
 - Longer, more thorough coverage of a contribution
- Books (textbooks) *→ Good for learning new things.*
 - Established methods will plenty of background
- Magazines / Media / Web *→ good for basic context.*
 - Great for context, but limited academic credibility

How to find papers: strategy

- Follow up references of other works
- Look for a survey paper (summary of papers)
- General searching
 - By topic – search widely and **be inclusive**
 - By author • By event • By journal
- Breadth first versus depth first?
- **Try everything**

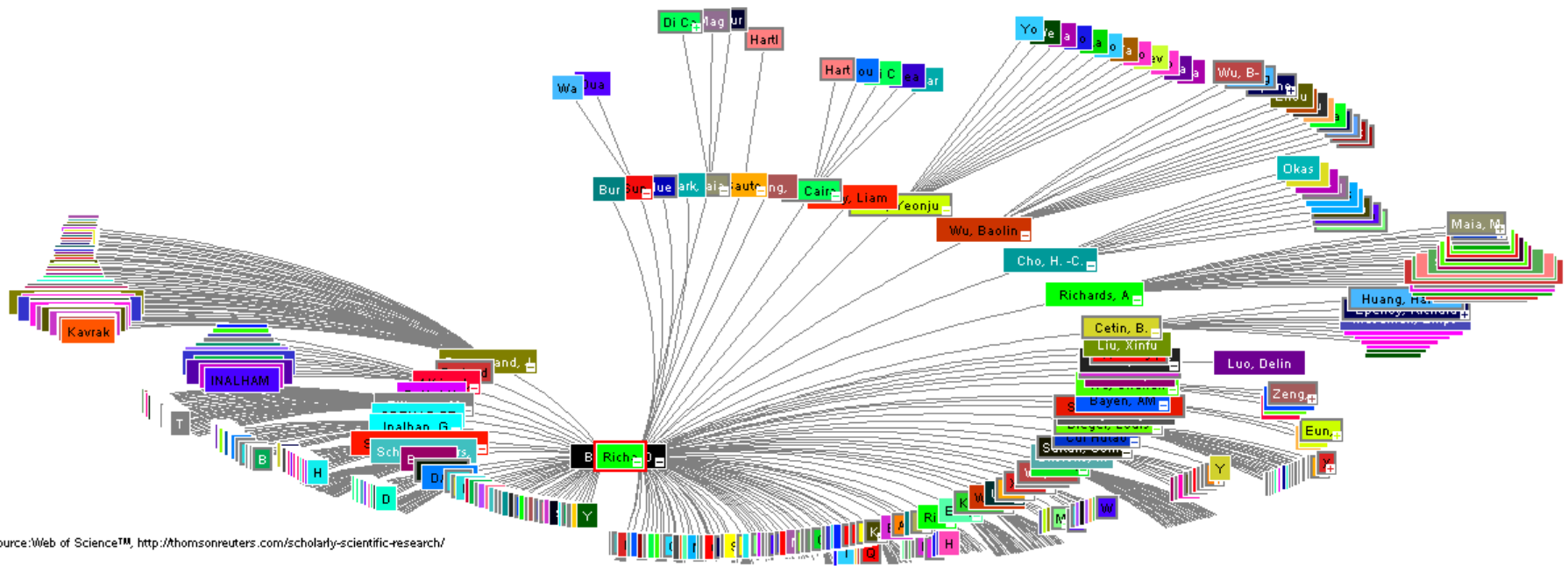
Can often follow the 'tree' of citations



Citation Map

→ Not really necessary.

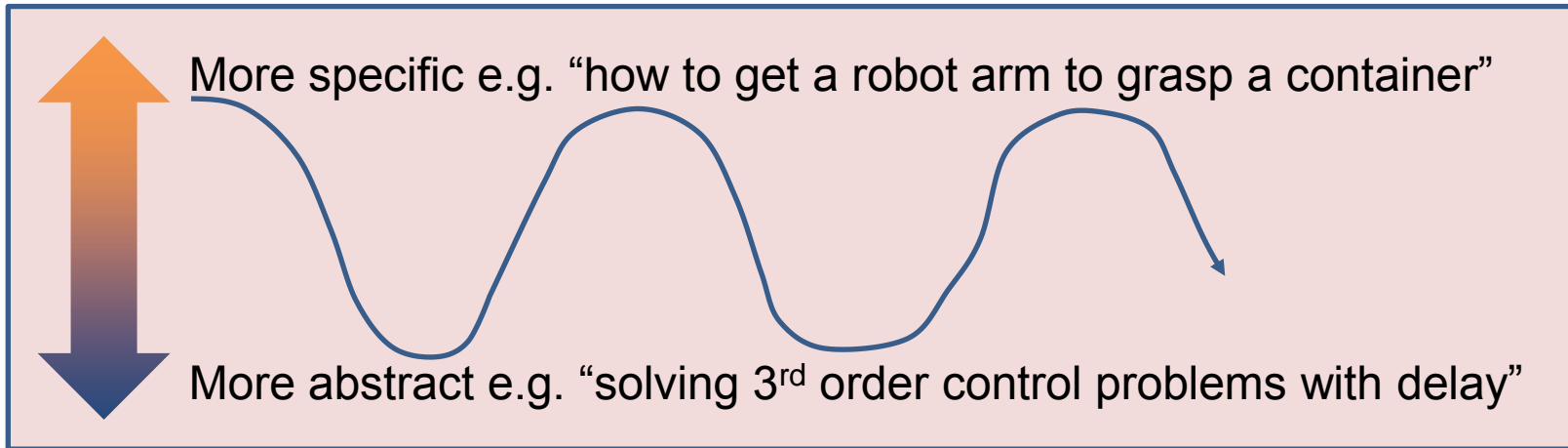
- Pretty!



Source: Web of Science™, <http://thomsonreuters.com/scholarly-scientific-research/>

Focussing versus Abstraction

- A typical research journey



- Reading follows similar trajectory
- Have you tried abstracting?

eg: UAV flying in wind
↳ abstracting → Control in a
wind field/liquid flow.

How to find papers: tactics

• Wikipedia useful
↳ but don't cite
directly.

- Google scholar: <http://scholar.google.com>
 - Also follow up through Google citations and alerts
- Web of science: <http://wok.mimas.ac.uk/>
 - ↳ note, usually found by Google scholar.
- IEEE Xplore: <http://ieeexplore.ieee.org/> (lots of tech research)
 - University subscriptions: use web proxy
<http://www.bristol.ac.uk/it-services/advice/homeusers/webcache/auth/>

How to find papers: tactics for robotics

- The big conferences:

- IROS

- ICRA

- Journals

← less prominent in robotics.

- Journal of Field Robotics

- IEEE Transactions on Robotics

- Robotics and Autonomous Systems

Links

- ICRA: <http://ieeexplore.ieee.org/xpl/conhome.jsp?punumber=1000639>
- IROS: <http://ieeexplore.ieee.org/xpl/conhome.jsp?punumber=1000393>
- JFR: [http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1556-4967](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1556-4967)
- TRO: <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8860>
- <http://www.journals.elsevier.com/robotics-and-autonomous-systems/>

Cataloguing your reading

- Valuable to quickly recall and cite papers you have read: keep a **database** of your reading

- Various tools for this

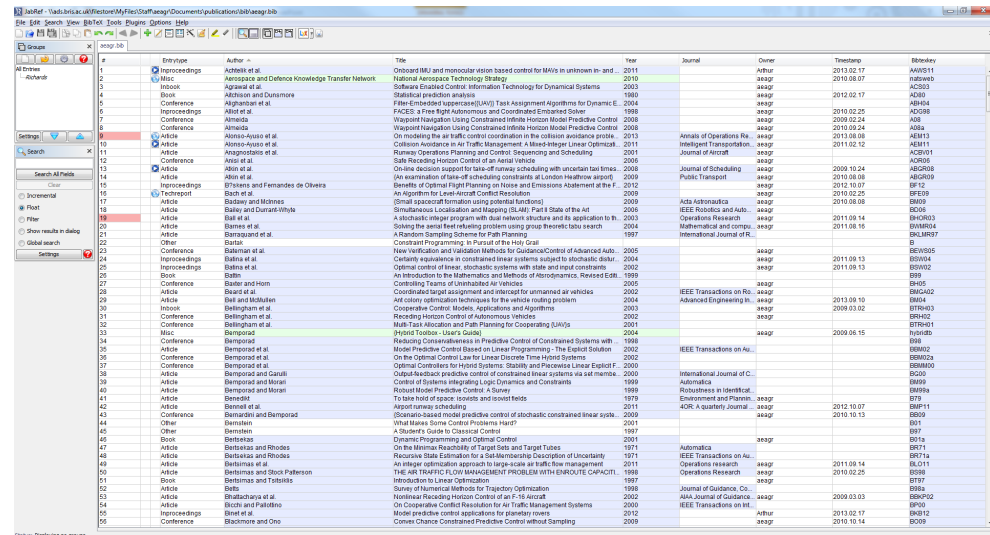
- Mendeley
- EndNote

- I'm a big fan of **JabRef**

- Free, all-platform

- Based on bibtex (more later)

- <http://jabref.sourceforge.net>



The screenshot shows the JabRef application window with a list of bibliographic entries. The entries are displayed in a table with columns for #, Entry type, Author, Title, Year, Journal, Owner, Timestamp, and Bibtey. The list includes various papers related to autonomous systems, traffic management, and control systems.

#	Entry type	Author	Title	Year	Journal	Owner	Timestamp	Bibtey
1	Article	Ackel et al.	Onboard (M2) and monocular vision based control for MAVs in unknown in- and	2011		Author	2012.02.17	AK0511
2	Article	Agarwal et al.	National Aerospace Technology Strategy	2010		aseg	2010.08.07	natweb
3	Article	Agarwal et al.	Software Enabled Control: Information Technology for Dynamical Systems	2003		aseg	2010.02.17	ACS03
4	Article	Agarwal et al.	Statistical prediction analysis	1989		aseg	2010.02.17	ACS89
5	Article	Alghamdi et al.	File-Embedded supercar (FLESC) Task Assignment Algorithms for Dynamic E	2004		aseg	2010.02.25	AB04
6	Article	Alghamdi et al.	FLESC: a File-Embedded supercar (FLESC) Task Assignment Algorithms for Dynamic E	2004		aseg	2010.02.25	AB04
7	Article	Alghamdi et al.	Vehicle Navigation Using Constrained Inference Horizon Model Predictive Control	2008		aseg	2009.02.24	AB08
8	Article	Alghamdi et al.	Vehicle Navigation Using Constrained Inference Horizon Model Predictive Control	2008		aseg	2010.02.24	AB08
9	Article	Alghamdi et al.	On modeling the air traffic control coordination in the collision avoidance proble	2011		aseg	2010.08.08	AB11
10	Article	Alghamdi et al.	Collision Avoidance in Air Traffic Management: A Mixed-Integer Linear Optimiz	2011		aseg	2010.08.08	AB11
11	Article	Alghamdi et al.	Runway Operations Planning and Control: Sequencing and Scheduling	2009		aseg	2010.02.12	AC09
12	Article	Alghamdi et al.	Safety Receding Horizon Control of an Aerial Vehicle	2009		aseg	2010.08.08	AB09
13	Article	Alghamdi et al.	Online decision support for take-off runway scheduling with uncertain taxi times	2008		aseg	2009.10.24	AB08
14	Article	Alghamdi et al.	An examination of time-off scheduling constraints at London Heathrow airport	2009		aseg	2010.02.25	BF09
15	Article	Alghamdi et al.	Benefits of Optimal Flight Planning on Noise and Emissions Abatement at the F	2012		aseg	2012.10.07	BF12
16	Article	Alghamdi et al.	An Algorithm for Low-level Conflict Resolution	2009		aseg	2010.08.08	AB09
17	Article	Alghamdi et al.	Small spacecraft formation using potential function	2009		aseg	2010.08.08	AB09
18	Article	Alghamdi et al.	Simultaneous Localization and Mapping (SLAM) Part I: State of the art	2006		aseg	2010.08.08	AB06
19	Article	Alghamdi et al.	A stochastic integer program with dual network structure and its application to th	2003		aseg	2010.08.08	AB03
20	Article	Alghamdi et al.	Solving the aerial refueling problem using gross benefit tabu search	2004		aseg	2010.08.08	AB04
21	Article	Alghamdi et al.	A Random Sampling Scheme for Path Planning	1997		aseg	2010.08.08	AB97
22	Article	Alghamdi et al.	Constant Programming in Pursuit of the Holy Grail	2005		aseg	2010.08.08	AB05
23	Article	Alghamdi et al.	New verification and validation methods for Guidance/Control of Advanced Aut	2005		aseg	2010.08.08	AB05
24	Article	Alghamdi et al.	Control of linear, stochastic systems with state and input constraints	2002		aseg	2010.08.08	AB02
25	Article	Alghamdi et al.	An introduction to the mathematics and methods of Aerodynamics, Revised Edit	1998		aseg	2010.08.08	AB98
26	Article	Alghamdi et al.	Controlling Teams of Unmanned Air Vehicles	2002		aseg	2010.08.08	AB02
27	Article	Alghamdi et al.	Coordinated target assignment and control for unmanned air vehicles	2002		aseg	2010.08.08	AB02
28	Article	Alghamdi et al.	Art colony optimization techniques for the vehicle routing problem	2004		aseg	2010.08.08	AB04
29	Article	Alghamdi et al.	Cooperative Control: Models, Applications and Algorithms	2003		aseg	2010.08.08	AB03
30	Article	Alghamdi et al.	Receding-horizon Control of Autonomous Vehicles	2002		aseg	2010.08.08	AB02
31	Article	Alghamdi et al.	Multi-Task Allocation and Path Planning for Cooperating UAVs	2004		aseg	2010.08.08	AB04
32	Article	Alghamdi et al.	Hybrid Topdown-User's Guide	2004		aseg	2010.08.08	AB04
33	Article	Alghamdi et al.	Reducing Conservativeness in Predictive Control of Constrained Systems with	1999		aseg	2010.08.08	AB99
34	Article	Alghamdi et al.	Model Predictive Control Based on Linear Programming: The Explicit Solution	2002		aseg	2010.08.08	AB02
35	Article	Alghamdi et al.	On the Optimal Control Law for Linear Discrete Time Hybrid Systems	2002		aseg	2010.08.08	AB02
36	Article	Alghamdi et al.	Optimal Control for Hybrid Systems, Discrete and Piecewise Linear Explicit F	2000		aseg	2010.08.08	AB00
37	Article	Alghamdi et al.	Output-feedback predictive control of constrained linear systems via set memo	2000		aseg	2010.08.08	AB00
38	Article	Alghamdi et al.	Control of Systems Integrating Logic Dynamics and Constraints	1999		aseg	2010.08.08	AB99
39	Article	Alghamdi et al.	Robust Model Predictive Control: A Survey	1999		aseg	2010.08.08	AB99
40	Article	Alghamdi et al.	To take hold of space, vessels and towed nets	1979		aseg	2010.08.08	AB79
41	Article	Alghamdi et al.	Apopt neuron scheduling	2011		aseg	2012.10.07	BM11
42	Article	Alghamdi et al.	Stochastic-based model predictive control of stochastic constrained linear syste	2011		aseg	2010.10.13	BM11
43	Article	Alghamdi et al.	What Makes Some Control Problems Hard?	2001		aseg	2010.08.08	AB01
44	Article	Alghamdi et al.	A Stochastic Control Problem	1997		aseg	2010.08.08	AB97
45	Article	Alghamdi et al.	Dynamic Programming and Optimal Control	1971		aseg	2010.08.08	AB71
46	Article	Alghamdi et al.	Recursive State Estimation for a Self-Monitoring Description of Uncertainty	1971		aseg	2010.08.08	AB71
47	Article	Alghamdi et al.	An integer optimization approach to large-scale air traffic flow management	2011		aseg	2010.08.08	AB11
48	Article	Alghamdi et al.	THE AIR TRAFFIC FLOW MANAGEMENT PROBLEM WITH ENROUTE CAPACITY	1999		aseg	2010.08.08	AB99
49	Article	Alghamdi et al.	Introduction to Linear Optimization	1998		aseg	2010.08.08	AB98
50	Article	Alghamdi et al.	Survey of Numerical Methods for Trajectory Optimization	2002		aseg	2010.08.08	AB02
51	Article	Alghamdi et al.	Controlled Receding Horizon Control of an F-16 Aircraft	2002		aseg	2010.08.08	AB02
52	Article	Alghamdi et al.	On Cooperative Control Resolution for Air Traffic Management Systems	2000		aseg	2010.08.08	AB00
53	Article	Alghamdi et al.	Model predictive control applications for planetary rovers	2012		aseg	2010.10.14	BC12
54	Article	Alghamdi et al.	Convex Chance Constrained Predictive Control without Sampling	2009		aseg	2010.10.14	BC09

JabRef

JabRef - \\ads.bris.ac.uk\filestore\MyFiles\Staff\aeagr\Documents\publications\bib\aeagr.bib

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groups aeagr.bib

#	Entrytype	Author	Title	Year	Journal	Owner	Timestamp	Bibtexkey
1	Inproceedings	Achtelik et al.	Onboard IMU and monocular vision based control for MAVs in unknown in- and ...	2011		Arthur	2013.02.17	AAWS11
2	Misc	Aerospace and Defence Knowledge Transfer Network	National Aerospace Technology Strategy	2010		aeagr	2010.08.07	natsweb
3	Inbook	Agrawal et al.	Software Enabled Control: Information Technology for Dynamical Systems	2003		aeagr		ACS03
4	Book	Aitchison and Dunsmore	Statistical prediction analysis	1980		aeagr	2012.02.17	AD80
5	Conference	Alighanbari et al.	Filter-Embedded uppercase([UAV]) Task Assignment Algorithms for Dynamic E...	2004		aeagr		ABH04
6	Inproceedings	Alliot et al.	FACES: a Free flight Autonomous and Coordinated Embarked Solver	1998		aeagr	2010.02.25	ADG98
7	Conference	Almeida	Waypoint Navigation Using Constrained Infinite Horizon Model Predictive Control	2008		aeagr	2009.02.24	A08
8	Conference	Almeida	Waypoint Navigation Using Constrained Infinite Horizon Model Predictive Control	2008		aeagr	2010.09.24	A08a
9	Article	Alonso-Ayuso et al.	On modeling the air traffic control coordination in the collision avoidance proble...	2013	Annals of Operations Re...	aeagr	2013.08.08	AEM13
10	Article	Alonso-Ayuso et al.	Collision Avoidance in Air Traffic Management: A Mixed-Integer Linear Optimizati...	2011	Intelligent Transportation...	aeagr	2011.02.12	AEM11
11	Article	Anagnostakis et al.	Runway Operations Planning and Control: Sequencing and Scheduling	2001	Journal of Aircraft	aeagr		ACBV01
12	Conference	Anisi et al.	Safe Receding Horizon Control of an Aerial Vehicle	2006		aeagr		ACR06
13	Article	Atkin et al.	On-line decision support for take-off runway scheduling with uncertain taxi times...	2008	Journal of Scheduling	aeagr	2009.10.24	ABGR08
14	Article	Atkin et al.	(An examination of take-off scheduling constraints at London Heathrow airport)	2009	Public Transport	aeagr	2010.08.08	ABGR09
15	Inproceedings	B7skens and Fernandes de Oliveira	Benefits of Optimal Flight Planning on Noise and Emissions Abatement at the F...	2012		aeagr	2012.10.07	BF12
16	Techreport	Bach et al.	An Algorithm for Level-Aircraft Conflict Resolution	2009		aeagr	2010.02.25	BF09
17	Article	Badawy and McInnes	(Small spacecraft formation using potential functions)	2009	Acta Astronautica	aeagr	2010.08.08	BM09
18	Article	Bailey and Durrant-Whyte	Simultaneous Localisation and Mapping (SLAM): Part II State of the Art	2006	IEEE Robotics and Auto...	aeagr		BD06
19	Article	Ball et al.	A stochastic integer program with dual network structure and its application to th...	2003	Operations Research	aeagr	2011.09.14	BHOR03
20	Article	Barnes et al.	Solving the aerial fleet refueling problem using group theoretic tabu search	2004	Mathematical and compu...	aeagr	2011.08.16	BVMR04
21	Article	Barraquand et al.	A Random Sampling Scheme for Path Planning	1997	International Journal of R...			BKLMR97
22	Other	Bartak	Constraint Programming: In Pursuit of the Holy Grail					B
23	Conference	Bateman et al.	New Verification and Validation Methods for Guidance/Control of Advanced Auto...	2005		aeagr		BEWS05
24	Inproceedings	Batina et al.	Certainty equivalence in constrained linear systems subject to stochastic distur...	2004		aeagr	2011.09.13	BSW04
25	Inproceedings	Batina et al.	Optimal control of linear, stochastic systems with state and input constraints	2002		aeagr	2011.09.13	BSW02
26	Book	Batlin	An Introduction to the Mathematics and Methods of Astrodynamics, Revised Editi...	1999				B99
27	Conference	Baxter and Horn	Controlling Teams of Uninhabited Air Vehicles	2005		aeagr		BH05
28	Article	Beard et al.	Coordinated target assignment and intercept for unmanned air vehicles	2002	IEEE Transactions on Ro...	aeagr		BMGA02
29	Article	Bell and McMullen	Ant colony optimization techniques for the vehicle routing problem	2004	Advanced Engineering In...	aeagr	2013.09.10	BM04
30	Inbook	Bellingham et al.	Cooperative Control: Models, Applications and Algorithms	2003		aeagr	2009.03.02	BTRH03
31	Conference	Bellingham et al.	Receding Horizon Control of Autonomous Vehicles	2002		aeagr		BRH02
32	Conference	Bellingham et al.	Multi-Task Allocation and Path Planning for Cooperating (UAV)s	2001				BTRH01
33	Misc	Bemporad	(Hybrid Toolbox - User's Guide)	2004		aeagr	2009.06.15	hybridtb
34	Conference	Bemporad	Reducing Conservativeness in Predictive Control of Constrained Systems with ...	1998				B98
35	Article	Bemporad et al.	Model Predictive Control Based on Linear Programming - The Explicit Solution	2002	IEEE Transactions on Au...			BBM02
36	Conference	Bemporad et al.	On the Optimal Control Law for Linear Discrete Time Hybrid Systems	2002				BBM02a
37	Conference	Bemporad et al.	Optimal Controllers for Hybrid Systems: Stability and Piecewise Linear Explicit F...	2000				BBMM00
38	Article	Bemporad and Garulli	Output-feedback predictive control of constrained linear systems via set membe...	2000	International Journal of C...			BG00
39	Article	Bemporad and Morari	Control of Systems Integrating Logic Dynamics and Constraints	1999	Automatica			BM99
40	Article	Bemporad and Morari	Robust Model Predictive Control: A Survey	1999	Robustness in Identificat...			BM99a
41	Article	Benedikt	To take hold of space: isovists and isovist fields	1979	Environment and Plannin...	aeagr		B79
42	Article	Bennell et al.	Airport runway scheduling	2011	4OR: A quarterly Journal...	aeagr	2012.10.07	BMP11
43	Conference	Bernardini and Bemporad	(Scenario-based model predictive control of stochastic constrained linear syste...	2009		aeagr	2010.10.13	BB09
44	Other	Bernstein	What Makes Some Control Problems Hard?	2001				B01
45	Other	Bernstein	A Student's Guide to Classical Control	1997				B97
46	Book	Bertsekas	Dynamic Programming and Optimal Control	2001		aeagr		B01a
47	Article	Bertsekas and Rhodes	On the Minimax Reachability of Target Sets and Target Tubes	1971	Automatica			BR71
48	Article	Bertsekas and Rhodes	Recursive State Estimation for a Set-Membership Description of Uncertainty	1971	IEEE Transactions on Au...			BR71a
49	Article	Bertsimas et al.	An integer optimization approach to large-scale air traffic flow management	2011	Operations research	aeagr	2011.09.14	BL011
50	Article	Bertsimas and Stock Patterson	THE AIR TRAFFIC FLOW MANAGEMENT PROBLEM WITH ENROUTE CAPACIT...	1998	Operations Research	aeagr	2010.02.25	BS98
51	Book	Bertsimas and Tsitsiklis	Introduction to Linear Optimization	1997		aeagr		B797
52	Article	Betts	Survey of Numerical Methods for Trajectory Optimization	1998	Journal of Guidance, Co...			B98a
53	Article	Bhattacharya et al.	Nonlinear Receding Horizon Control of an F-16 Aircraft	2002	AIAA Journal of Guidance...	aeagr	2009.03.03	BBKP02
54	Article	Bicchi and Pallottino	On Cooperative Conflict Resolution for Air Traffic Management Systems	2000	IEEE Transactions on Int...			BP00
55	Inproceedings	Binet et al.	Model predictive control applications for planetary rovers	2012		Arthur	2013.02.17	BKB12
56	Conference	Blackmore and Ono	Convex Chance Constrained Predictive Control without Sampling	2009		aeagr	2010.10.14	BO09

Status: Displaying no groups.

Grabbing Bibtex

- Google scholar → Settings → Bibliography
- Xplore → Download citations
- Most journal websites provide options
- Can copy and paste directly into JabRef
- ***Warning: read what you cite!***

Summary

- Reading can be done on many levels
- A reading “journey” can progress in many ways
- Tools and support to help you find, catalogue and cite your reading

Charles Darwin

“Ignorance more frequently begets confidence than does knowledge”

The Descent of Man (1871)

Reading Group – First Assignment

- All on UoB Blackboard
 - www.ole.bris.ac.uk
- On your marks. Get set. **Go!**