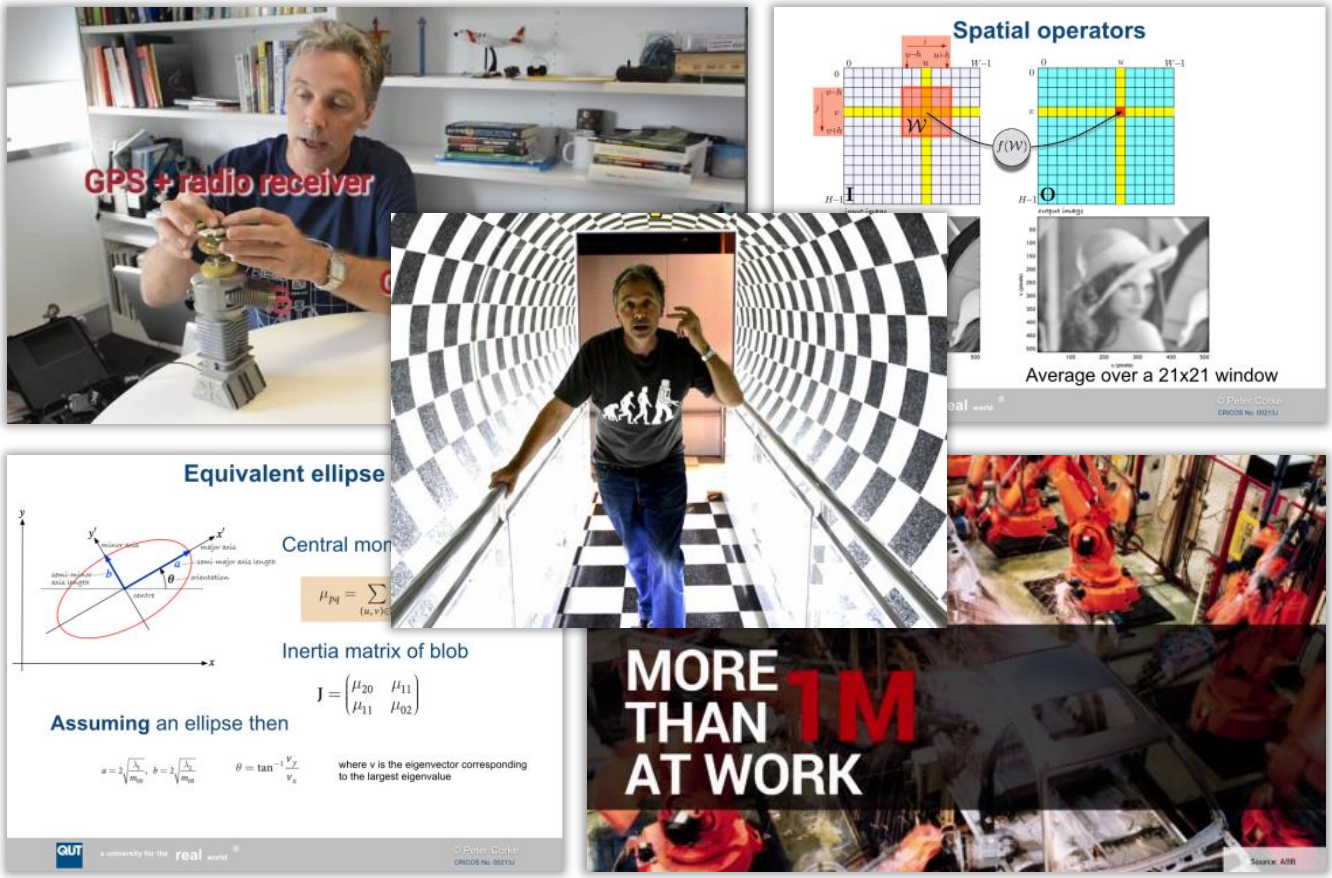
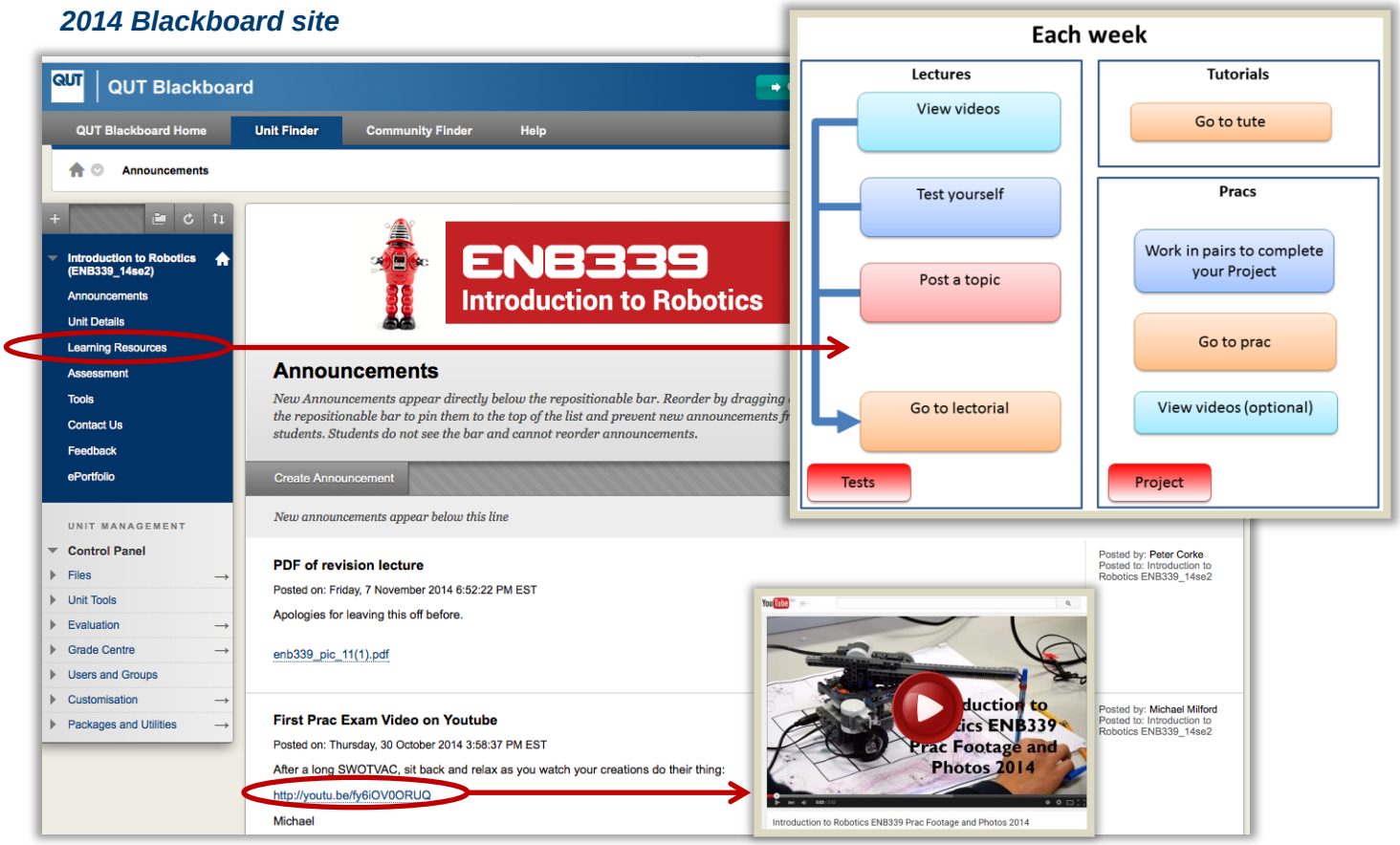
Students learning robotics

Blended learning environments

Example lecture slides



2014 Blackboard site



Additional student feedback from QUT surveys (2012–2014 QUT students)

Deepening understanding through unit design:

The extraordinary thing about Peter's unit ENB339 is the way he has designed it. He has combined both the knowledge and application together.

Exposing students to the short videos and opening up discussion on topics that where found most difficult helped with the understanding of content … this approach helped me learn and grew my passion for the topic.

The setup of the course made class time extremely useful and more productive. By looking at lecture videos and readings before lectures this allowed the students to see what topics were more tricky and lectures where based around our questions or reviewing/ further explanation of topics we found challenging

Deepening understanding through clear explanations:

… makes it easy for us to understand and incrementally teaches us so we understand everything step by step.

… the way he can explain his ideas and concepts that he has learnt from his years of experience make the lessons enjoyable and immersive.

Influencing learning through enthusiasm and commitment:

Peter's infectious enthusiasm towards his topics during lectures was undeniable. His in-depth knowledge and ideas encouraged me to continue exploring not just how to solve the exam questions, but to continue thinking what problems could be solved from the new skills learnt.

His enthusiasm for robotics and vision was a great help and inspiration to complete my studies.

Having a teacher with this commitment to both teaching and content makes it a lot easier to commit to the subject yourself, and makes learning an enjoyable experience.

He really cares about his work, and that made the students care about what he thought about their work, and made me want to try harder and got me excited about the work we were doing.

Inspiring learning through the possibilities of robotics:

His teaching style nurtured the growth and imagination about the possibilities and applications of Robotics. Needless to say, his devotion helped develop a deeper understanding of where the future can be directed with regards to Robotics.

By linking robotics to real world applications, especially in his own personal experiences it links you more with the community and allows you to see the potential opportunities in that field.

… he demonstrates what a robotics major can do in the world.

Linking learning with real world experiences and examples:

Peters experience and ability to reference real world projects demonstrated the link between the class room and opportunity's to use what we had been learning in real projects.

Peter's immense knowledge and variety of current and past projects/research has positively influenced my learning by his technical and teaching competence and his very practical way of giving examples - he has always been very open to having students be involved in robotics projects.

Peter went out of his way to think of ways to break down complex concepts and gives his students a way to be able to visualise scenarios. By doing this he was actively giving us tools to help with our problem solving ability.

Providing authentic experiential learning experiences:

Having the hands on project helped to understand the content and see it applied. Actually building a robot was key in understanding the fine-tuning required to get a robot working. And it was so satisfying to have it work'.

Throughout the unit, we applied the theories that we were learning to the robot that we were building at the same time. This not only improved my understanding of the theory, but also kept me excited for class

each week. I think the unit was a spark that helped me grow into where I am now, a PhD Candidate in the Centre of Excellence for Robotic Vision'

The team project helps me engage more in self-learning, as well as a good experience in terms of practical works.

Learning by using materials in the real world (LEGO) ensured that the importance and relevance of the content was known. It had a strong influence in how I learnt in the unit.

I believe the structure of the projects and exams made for you to want to exceed, want you to learn and do your best. Coming out of the exams normally had some of us rush to the content and check if we were right, as opposed to running to the bar!

Supporting learners:

He was very welcoming, helpful and non-judgemental to people at all stages of learning.

Throughout the tutorials and computer labs Peter was always present and willing to provide on the spot feedback about any issues which arose. He was always open to feedback and quite willing to go over sections slowly or outside of class hours if necessary.

Peter was very open with engaging with the students and finding out if anything was wrong and then helping them or getting the problem fixed.

Reimagining learning through leading edge learning resources:

YouTube videos:

… provided the opportunity to reinforce concepts and to work at my own pace'

… if you had watched all the videos you were able to ask better questions in the lectorial'

…Best lecture on vision ever heard

…Please upload all the rest of your videos, I absolutely love your lecturing style' (YouTube comments, 2014).

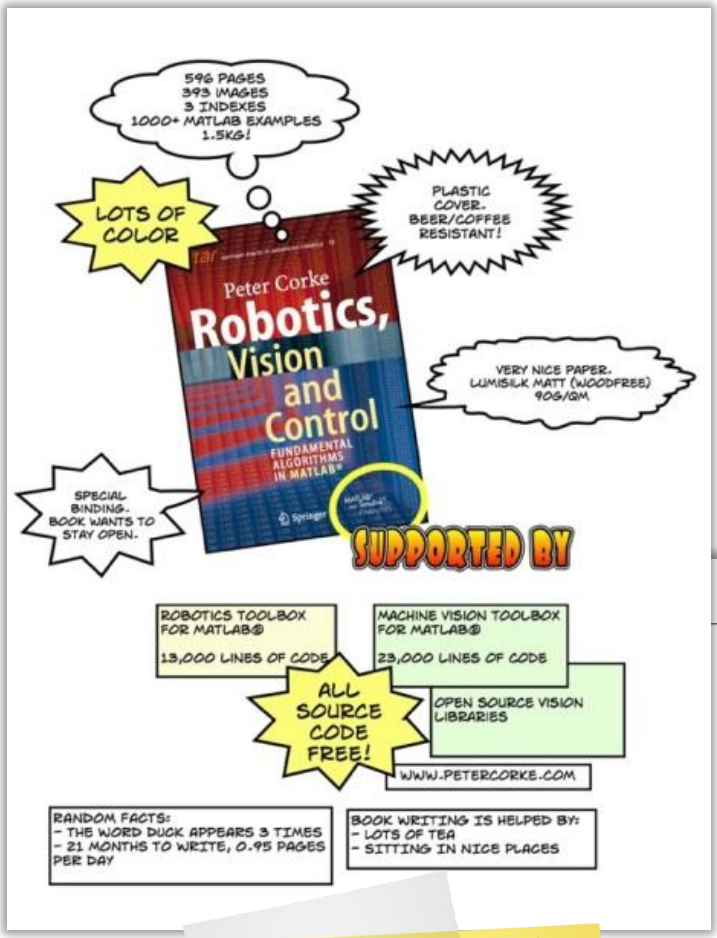
Matlab toolboxes:

The toolboxes are invaluable and tremendously convenient (trying to solve the same problems without his toolboxes would be extremely painful)!'

… the toolbox gave us a great set of tools to implement content without the need for implementing hard algorithms'

Learning and teaching resources

Robotics, Vision and Control textbook



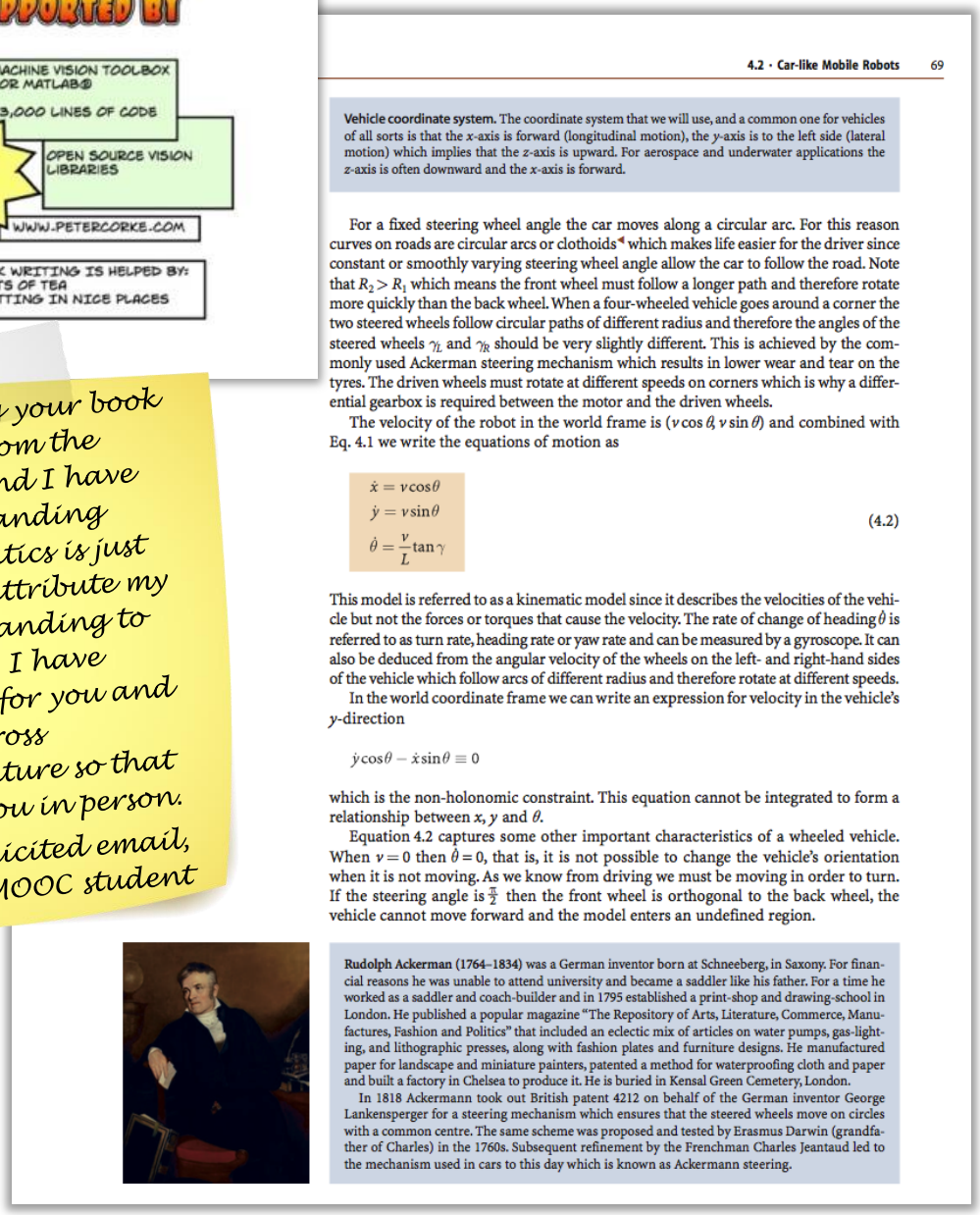
I have tried learning dynamics in many different books and always ended up with some gap between the theory and actual implementation. Your book is exactly what i was searching for. Thank You !!

Unsolicited email, MOOC student

I have been reading your book on Robotic Vision from the excerpts in MOOC and I have to say it is an outstanding book. The mathematics is just plain beautiful. I attribute my easiness of understanding to your literary skills. I have great admiration for you and I hope our paths cross sometime in the future so that I can say this to you in person.

Unsolicited email, MOOC student

Sample page from "Robotics, Vision and Control"



4.2 · Car-like Mobile Robots 69

Vehicle coordinate system. The coordinate system that we will use, and a common one for vehicles of all sorts is that the x-axis is forward (longitudinal motion), the y-axis is to the left side (lateral motion) which implies that the z-axis is upward. For aerospace and underwater applications the z-axis is often downward and the x-axis is forward.

For a fixed steering wheel angle the car moves along a circular arc. For this reason curves on roads are circular arcs or clothoids which makes life easier for the driver since constant or smoothly varying steering wheel angle allow the car to follow the road. Note that $R_2 > R_1$ which means the front wheel must follow a longer path and therefore rotate more quickly than the back wheel. When a four-wheeled vehicle goes around a corner the two steered wheels follow circular paths of different radius and therefore the angles of the steered wheels γ_L and γ_R should be very slightly different. This is achieved by the commonly used Ackerman steering mechanism which results in lower wear and tear on the tyres. The driven wheels must rotate at different speeds on corners which is why a differential gearbox is required between the motor and the driven wheels.

The velocity of the robot in the world frame is $(v\cos\theta, v\sin\theta)$ and combined with Eq. 4.1 we write the equations of motion as

$$\begin{aligned} \dot{x} &= v\cos\theta \\ \dot{y} &= v\sin\theta \\ \dot{\theta} &= \frac{v}{L}\tan\gamma \end{aligned} \tag{4.2}$$

This model is referred to as a kinematic model since it describes the velocities of the vehicle but not the forces or torques that cause the velocity. The rate of change of heading $\dot{\theta}$ is referred to as turn rate, heading rate or yaw rate and can be measured by a gyroscope. It can also be deduced from the angular velocity of the wheels on the left- and right-hand sides of the vehicle which follow arcs of different radius and therefore rotate at different speeds.

In the world coordinate frame we can write an expression for velocity in the vehicle's y-direction

$$\dot{y}\cos\theta - \dot{x}\sin\theta \equiv 0$$

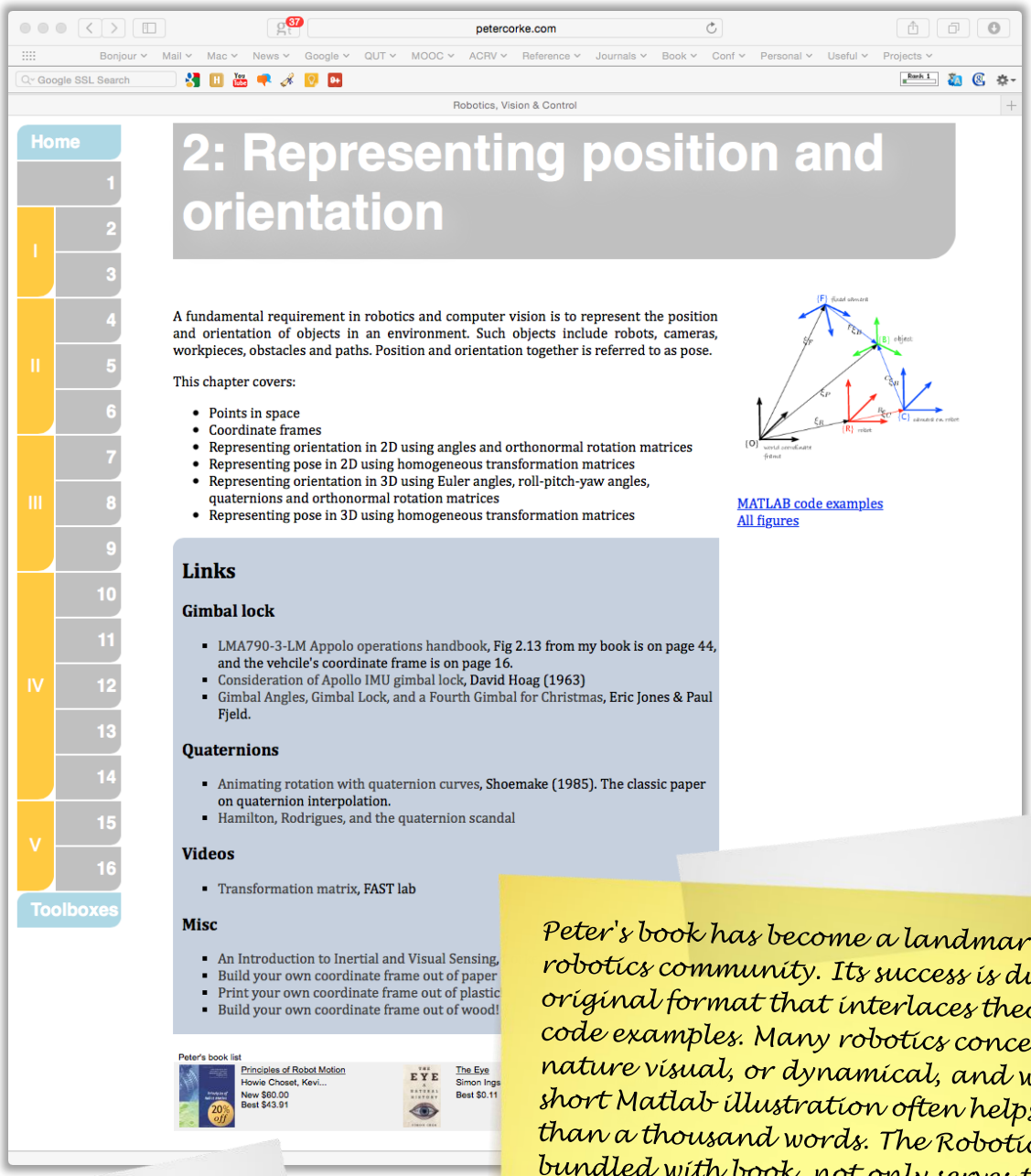
which is the non-holonomic constraint. This equation cannot be integrated to form a relationship between x, y and θ.

Equation 4.2 captures some other important characteristics of a wheeled vehicle. When $v = 0$ then $\dot{\theta} = 0$, that is, it is not possible to change the vehicle's orientation when it is not moving. As we know from driving we must be moving in order to turn. If the steering angle is $\frac{\pi}{2}$ then the front wheel is orthogonal to the back wheel, the vehicle cannot move forward and the model enters an undefined region.

Rudolph Ackerman (1764–1834) was a German inventor born at Schneeberg, in Saxony. For financial reasons he was unable to attend university and became a saddler like his father. For a time he worked as a saddler and coach-builder and in 1795 established a print-shop and drawing-school in London. He published a popular magazine "The Repository of Arts, Literature, Commerce, Manufactures, Fashion and Politics" that included an eclectic mix of articles on water pumps, gas-lighting, and lithographic presses, along with fashion plates and furniture designs. He manufactured paper for landscape and miniature painters, patented a method for waterproofing cloth and paper and built a factory in Chelsea to produce it. He is buried in Kensal Green Cemetery, London.

In 1818 Ackermann took out British patent 4212 on behalf of the German inventor George Lankensperger for a steering mechanism which ensures that the steered wheels move on circles with a common centre. The same scheme was proposed and tested by Erasmus Darwin (grandfather of Charles) in the 1760s. Subsequent refinement by the Frenchman Charles Jeantaud led to the mechanism used in cars to this day which is known as Ackermann steering.

Textbook website sample page



petercorke.com

Robotics, Vision & Control

Home

1 | I: 2, 3 | II: 4, 5, 6 | III: 7, 8, 9 | IV: 10, 11, 12, 13, 14 | V: 15, 16

Toolboxes

2: Representing position and orientation

A fundamental requirement in robotics and computer vision is to represent the position and orientation of objects in an environment. Such objects include robots, cameras, workpieces, obstacles and paths. Position and orientation together is referred to as pose.

This chapter covers:

- Points in space
- Coordinate frames
- Representing orientation in 2D using angles and orthonormal rotation matrices
- Representing pose in 2D using homogeneous transformation matrices
- Representing orientation in 3D using Euler angles, roll-pitch-yaw angles, quaternions and orthonormal rotation matrices
- Representing pose in 3D using homogeneous transformation matrices

MATLAB code examples
All figures

Links

Gimbal lock

- LMA790-3-LM Appolo operations handbook, Fig 2.13 from my book is on page 44, and the vehcile's coordinate frame is on page 16.
- Consideration of Apollo IMU gimbal lock, David Hoag (1963)
- Gimbal Angles, Gimbal Lock, and a Fourth Gimbal for Christmas, Eric Jones & Paul Fjeld.

Quaternions

- Animating rotation with quaternion curves, Shoemake (1985). The classic paper on quaternion interpolation.
- Hamilton, Rodrigues, and the quaternion scandal

Videos

- Transformation matrix, FAST lab

Misc

- An Introduction to Inertial and Visual Sensing,
- Build your own coordinate frame out of paper
- Print your own coordinate frame out of plastic
- Build your own coordinate frame out of wood!

Peter's book list

Principles of Robot Motion
Howie Choset, Kevi...
New $60.00
Best $43.91

The Eye
Simon Ings
Best $0.11

Pretty much covers all the essentials for programming / control of robots in conjunction with vision systems … In conjunction with the Matlab tool boxes provided, is an outstanding asset for developing complex robotic / vision systems.

Amazon review [5 stars], anonymous international student

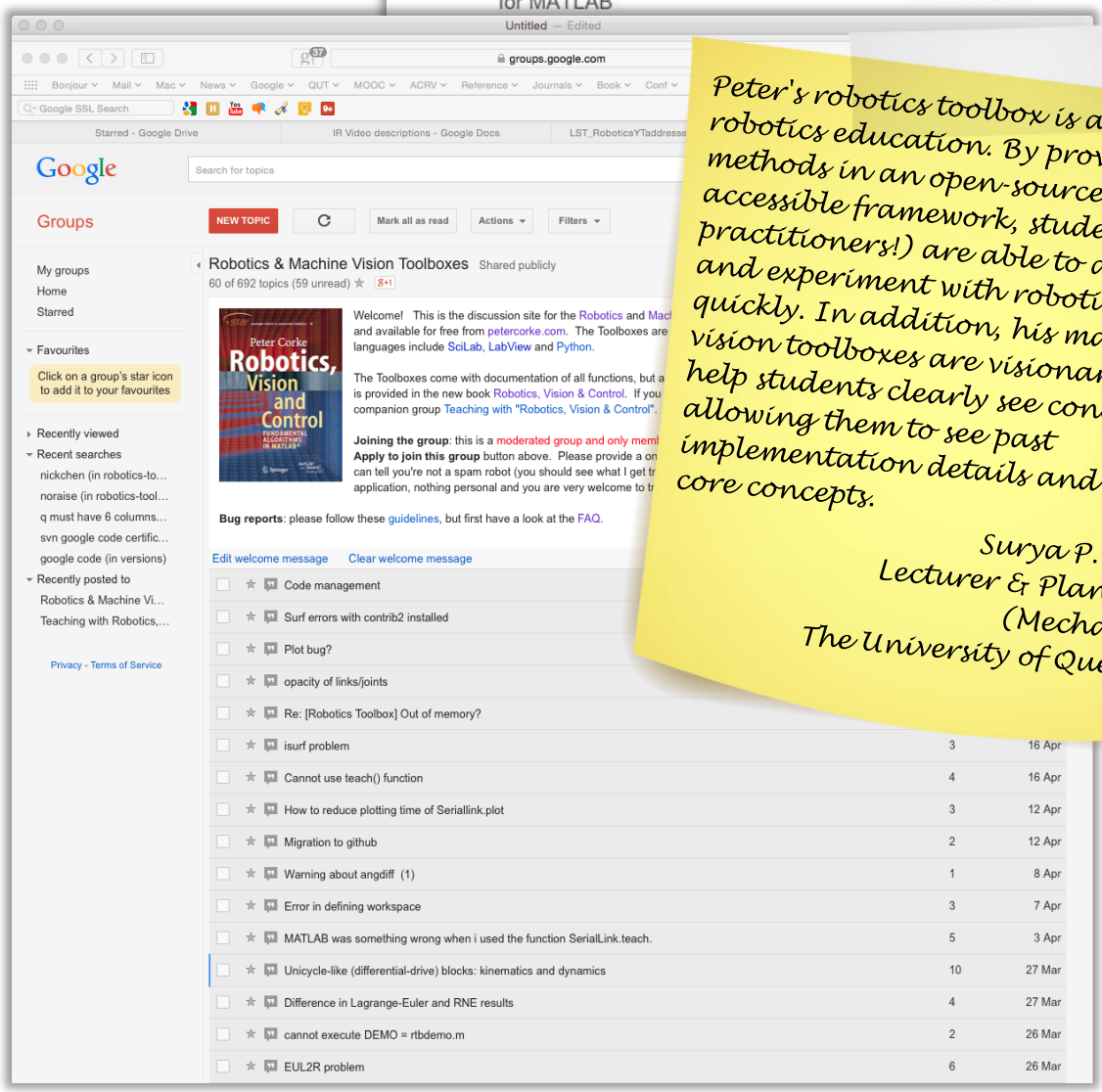
Peter's book has become a landmark of the robotics community. Its success is due to its original format that interlaces theory and code examples. Many robotics concepts are by nature visual, or dynamical, and watching a short Matlab illustration often helps more than a thousand words. The Robotics Toolbox, bundled with book, not only serves to illustrate the book; it has a large user base that predates the book's publication, and it continues to help Ph.D. students across the world to quickly prototype robot algorithms in Matlab. Peter's effort has a strong impact on the robotics community, allowing students to easily transform interest or curiosity for robotics into practical and theoretical skills, in a fun and seemingly effortless manner.

Renaud Detry, Postdoctoral Researcher, University of Liège, Belgium

MATLAB toolboxes

Peter's robust MATLAB toolbox that made the practical assessment better focused on learning the actual content instead of trying to design algorithms.

2014 student, QUT survey



Peter's robotics toolbox is a boon for robotics education. By providing core methods in an open-source and easily accessible framework, students (and practitioners!) are able to appreciate and experiment with robotics concepts quickly. In addition, his machine vision toolboxes are visionary and help students clearly see concepts by allowing them to see past implementation details and focus on core concepts.

Surya P. N. Singh,
Lecturer & Plan Director (Mechatronics),
The University of Queensland

MOOCs

Peter and the team's design, development and delivery of QUT's first two MOOCs makes Peter's pioneering approaches available to an international student population. The first MOOC course offers an introduction to the exciting world of robotics and the mathematics and algorithms that underpin it. It introduces the variety of robots and the diversity of tasks to which robotics knowledge and skills can be applied, and discusses the role of robots in society and associated ethical issues.

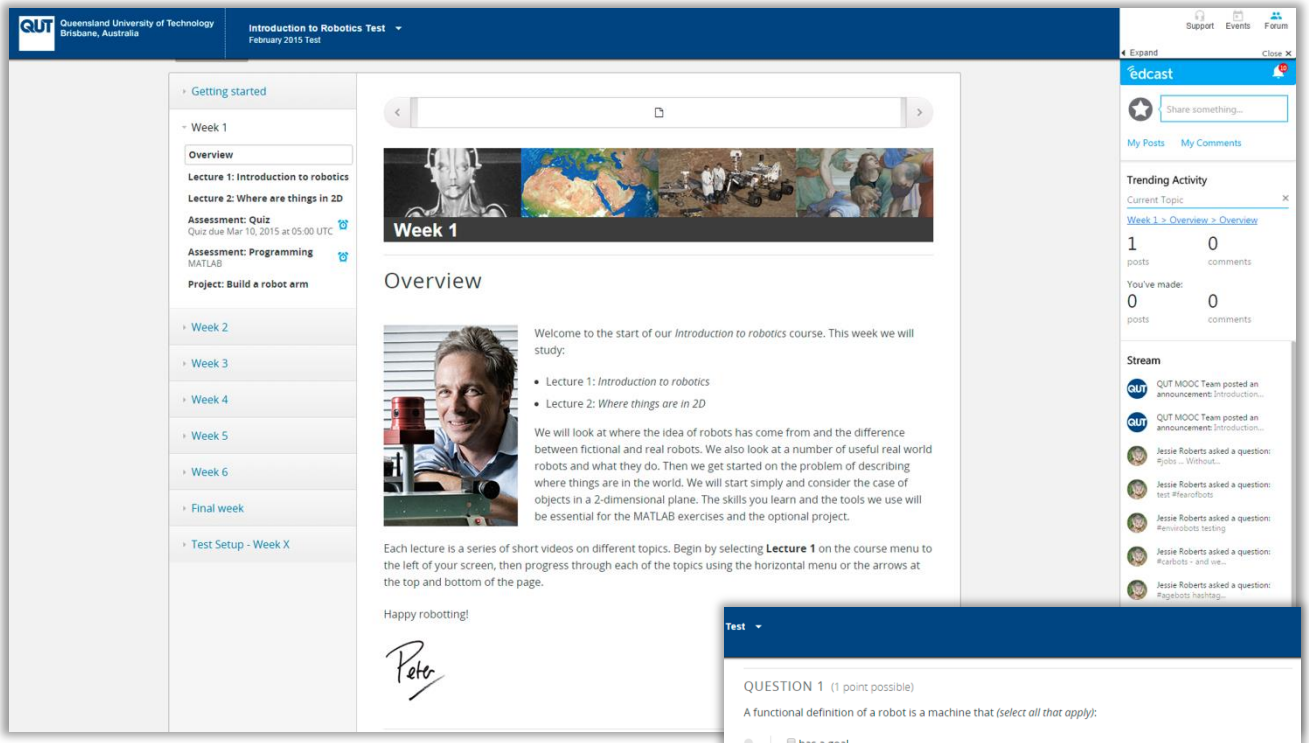
The second MOOC is an introduction to robotic vision, exploring how robots can use information from cameras to understand the world around them. Around 13,000 students from over 150 countries enrolled in the first of the six-week *Introduction to Robotics* course, launched for the first time in February 2015, and nearly 8,000 for the follow-up *Robotic Vision* course.

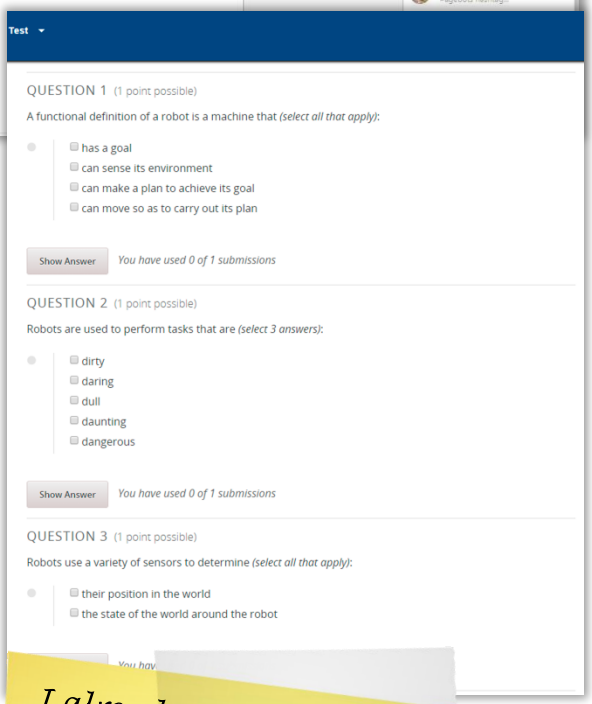
Much of the material was road-tested in the 2014 blended learning versions of Peter's QUT subjects. While the MOOCs comprise the usual features such as videos, animation, narrated PowerPoints, FAQs, discussion forum, mobile app cards, virtual events, quizzes, announcements and posts; they also contain a number of innovative and distinctive approaches to scaffold and deepen students' learning. For example, in the first MOOC, Peter negotiated with Mathworks, the US developer of MATLAB to integrate MATLAB software, and Springer for free PDFs of sections of his textbook. In addition, Peter collaborated with Mathworks to provide a customised arrangement to autograde students' programming tasks.

Furthermore, students were provided the opportunity to undertake an optional project which required the development of a robot arm using Lego or other technologies. Students were mentored each week by pre-recorded sessions made by one of the tutors. He recorded weekly demonstrations, and also walked through MATLAB demonstrations with them. Students who completed the project submitted a video of the robot arm working and they were assigned three peer reviewers. To rigorously scaffold students' peer review, they were taught how to peer review and practised on grading pre-prepared 'poor' and 'good' performances before conducting their review. Some examples of the final submissions are available on YouTube (https://youtu.be/CpMm0j1zB8o). Peter personally emailed the top 5% of completing students to congratulate them and also everyone who peer reviewed to thank them.

I found it very helpful in building the feeling that I am indeed participating in your class and not just reading a website or watching some YouTube videos.

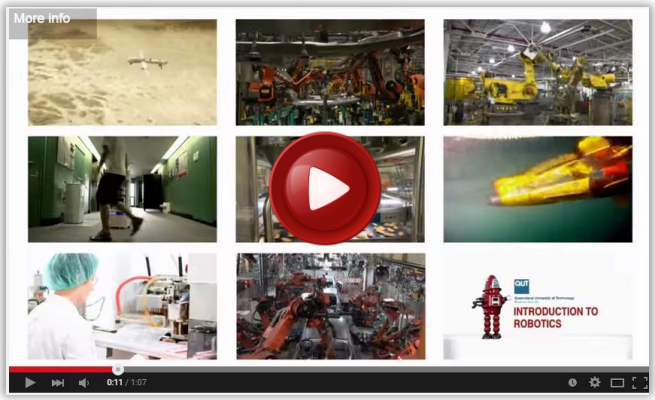
This MOOC is truly wonderful. We are getting a firm footing in the fundamentals apart from learning the application by way of programming…. In traditional university courses on mechatronics we study algorithms and the way a background application is running. This course offers a fresh paradigm in that we are able to apply the functions to gain a real world in-depth understanding i.e. the scope has multiplied!!





MOOC trailers

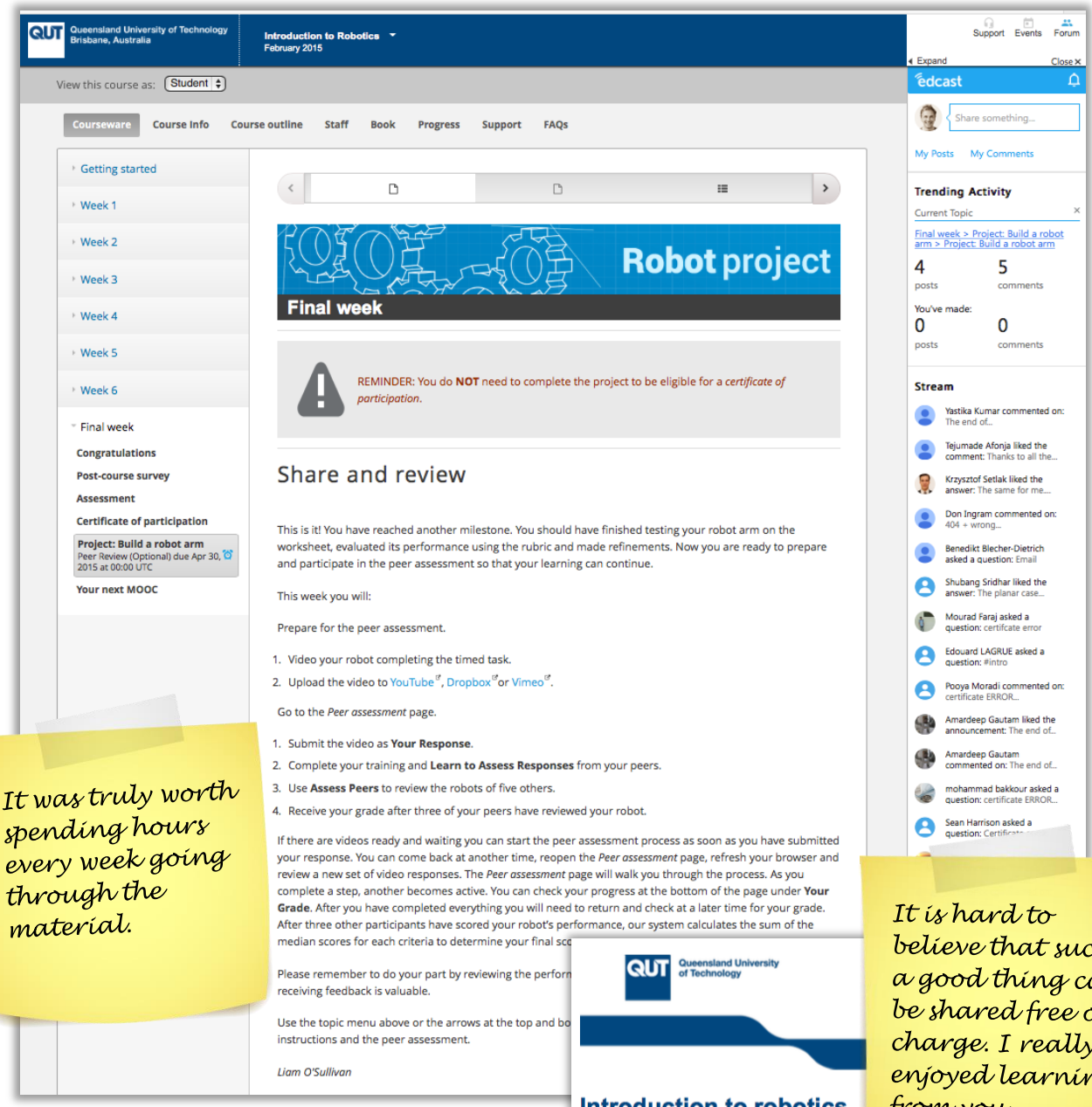
Introduction to Robotics MOOC trailer
https://www.youtube.com/



Robotic Vison MOOC trailer
https://www.youtube.com/

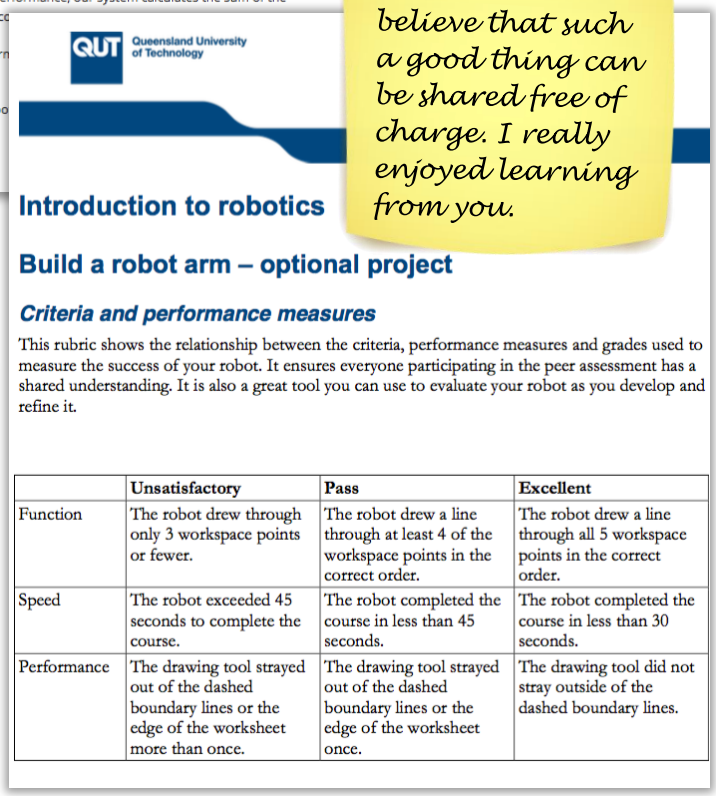
I already graduated from a 5yr course in Mechatronics Engineering in 2013 and I love how this course is structured, with a bit of everything that's vital to understanding robotics. It teaches some things I've studied in 1st year and some things I studied in 4th! And you've managed to do the great job of making it interesting and grasping rather than daunting and tedious. Would love to someday do a PhD with Prof. Corke.

Peer review process for the optional robot arm building project



It was truly worth spending hours every week going through the material.

It is hard to believe that such a good thing can be shared free of charge. I really enjoyed learning from you.



Queensland University of Technology

Introduction to robotics

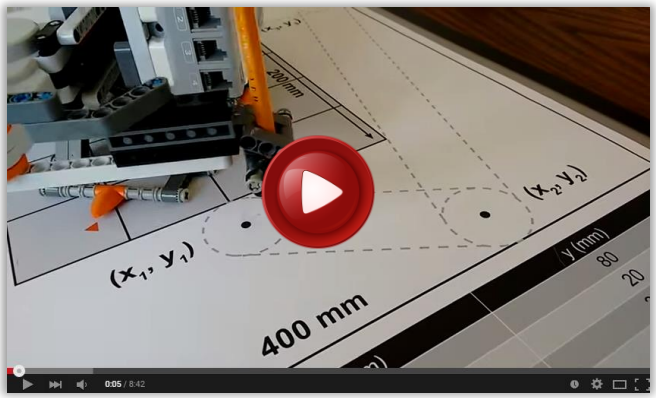
Build a robot arm – optional project

Criteria and performance measures

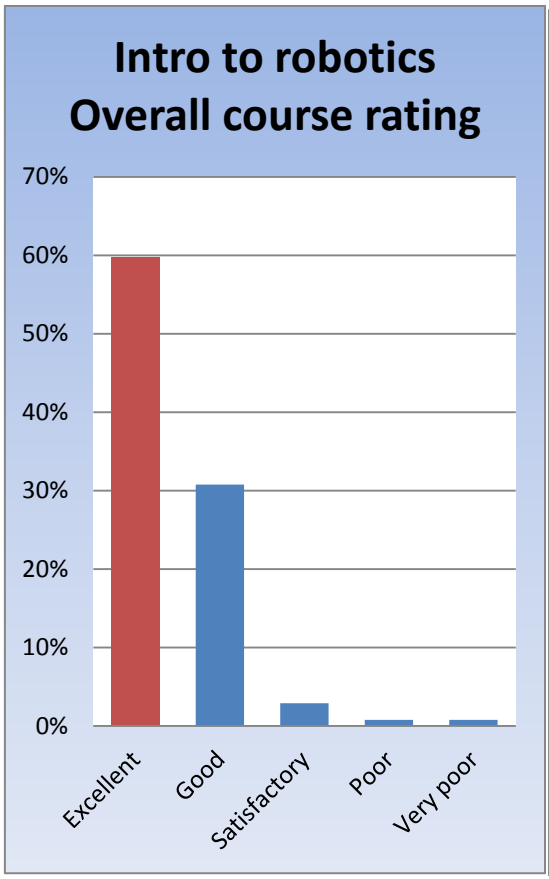
This rubric shows the relationship between the criteria, performance measures and grades used to measure the success of your robot. It ensures everyone participating in the peer assessment has a shared understanding. It is also a great tool you can use to evaluate your robot as you develop and refine it.

	Unsatisfactory	Pass	Excellent
Function	The robot drew through only 3 workspace points or fewer.	The robot drew a line through at least 4 of the workspace points in the correct order.	The robot drew a line through all 5 workspace points in the correct order.
Speed	The robot exceeded 45 seconds to complete the course.	The robot completed the course in less than 45 seconds.	The robot completed the course in less than 30 seconds.
Performance	The drawing tool strayed out of the dashed boundary lines or the edge of the worksheet more than once.	The drawing tool strayed out of the dashed boundary lines or the edge of the worksheet once.	The drawing tool did not stray outside of the dashed boundary lines.

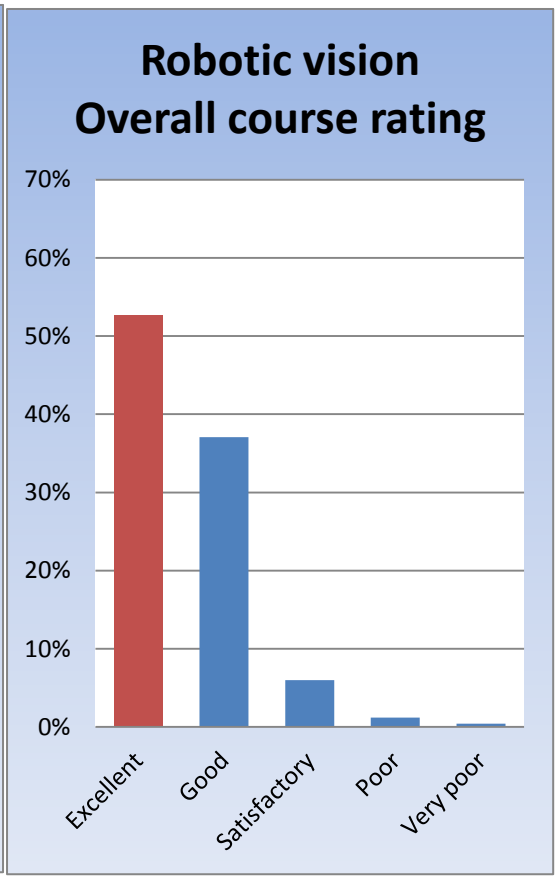
A video of a selection of students' projects
https://www.youtube.com/



Evaluation to date of the MOOCs



(Post course n=386)



(Post course n=254)

My overall impression of the class and how things are organized is that care for your students is quite evident, and the quality of the content is superb.

This is my first MOOC and I am converted; it has been a fun, educational experience. I've had a great time learning the math behind my crazy bots. I would also like to thank the 12,000-odd new friends I have, my MOOC classmates.

Please rate the quality and value of the Video lectures

	Intro to Robotics	Intro to Robotics	Robotic Vision	Robotic Vision
Excellent	299	77%	185	73%
Good	77	20%	62	24%
Poor	2	1%	1	0%
Satisfactory	6	2%	2	1%
Very Poor	2	1%	5	2%
Grand Total (n)	386	100%	255	100%

Please rate the quality and value of the Google hangouts

	Intro to Robotics	Intro to Robotics	Robotic Vision	Robotic Vision
Excellent	76	20%	42	17%
Good	90	23%	48	19%
N/A	173	45%	145	57%
Poor	7	2%	3	1%
Satisfactory	34	9%	15	6%
Very Poor	3	1%	1	0%
Grand Total (n)	383	100%	254	100%

Dear Peter, I really don't have words to express my gratitude to you, your team and your Institution for providing me of this great learning experience. I consider myself very fortunate going through Introduction to Robotics MOOC. It is something that I will carry with me forever. I truly believe your courses have instantly -a must watch- for the next generations of robotics to come. Your professional and educational service to Planet Earth is Immense.

Congratulations on the amazing job putting this course together! I have taken other MOOCs before and I am really impressed with the high quality of your lessons and material.

Additional MOOC feedback (posts, survey feedback and unsolicited emails)

Dear QUT MOOC folks,

A small group of students and I have been enjoying learning about robotics from the excellent MOOC that Professor Corke has developed. We're not interested in any credit or certificate, we've just been learning from the excellent lectures and working from his book and MATLAB examples. I'd like to encourage you to make this MOOC available on-demand, separately from the normal course timings. I believe that many people would be interested in self-study using these materials, absent the support of the forum, or the certifications. Likewise I was hoping to view the machine vision MOOC when I finished with the robotics one. Prof Corke has done an excellent job of presenting this material in an interesting and understandable way, showing both the theoretical underpinnings and practical applications. I would like to steer other students towards this course for self-study at odd times and would greatly appreciate if the MOOC were "always available". Please consider this request.

This is the best MOOC I've seen. It's a real treasure. Don't hide it under a basket.

Prof Joanne Bechta Dugan
Professor of Electrical & Computer Engineering Director of Computer
Engineering Programs University of Virginia

Sir, Your course is driving me crazy about robotics and I am a Undergraduate student of Urban Planner. I have cried for some times today as I will never be able learn more about robotics like you are teaching us within these 2 courses. No one will let me work on robotics as I am from different background though I am acquiring much more knowledge about robotics from your courses. You are the best teacher I have ever seen in my entire life time. I hope, one day I will be able enough to work with you. Thank you very very much for these 2 courses.

I am glad I did the course as I have been unemployed as a programmer for 2 years and this will give me a leg up. Before this I had to try and get a grant to do a short TAFE course but with this being nearly free (data cost me $110) and self-serve redoing it I feel I am bettering myself and getting my confidence back again. Students help each other whereas job applicants and competitors are always fighting so this was a much better environment to rebuild my IT and maths skills and confidence to get an IT job again. Thanks. Great idea and well done!

Thank you Prof. Peter Corke in cooperation with the Queensland University of Technology to provide opportunity for student in developing nations especially Papua New Guinea, where ROBOTICS is not taught as a Course in Computer Science and Engineering.

This is the first MOOC and I am converted. I have had a great time learning the math behind my crazy bots. I would also like to thank the 12,000 odd friends I have, my MOOC classmates.

I am very impressed with all involved in the teaching this course. I am a teacher in my field, but the passion and dedication shown by Prof Corke and his team is amazing.

I really enjoyed the live event Out and About with Robots. It was nice to have an informal event to learn more about your approach to the MOOC. I really appreciate your taking time to teach the mathematics behind the robots and for offering this course to us. I am really enjoying it. Thank you!

Great event, with a very personal touch. I found it very helpful in building the feeling that I am indeed participating in your class and not just reading a website or watching some YouTube videos.

Hi i am one of your students. (Robotic Vision - mooc). Enjoyed your course. Skimmed through almost all the chapters of your book when they were available for free to know the content. Ordered your book in Amazon and it is now in my hand. I have tried learning dynamics in many different books and always ended up with some gap between the theory and actual implementation. Your book is exactly what i was searching for. Thank You !! Going to start with the first chapter after sending this mail.

It is not that easy for someone like me lacking a technical background but it is still a lot of fun, hard but awesome (always loved math) and everything is very well done.

Thank you so much Professor Corke and the support staff for this wonderful course. An equally big thank you to all the other participants in the course without whom i would not have been able to achieve half the score I have. Hope to see you guys in the sequel.

Media

QUT news: https://www.qut.edu.au/


Queensland University of Technology
Brisbane, Australia

News

New centre will give robots the gift of sight

18 March 2014

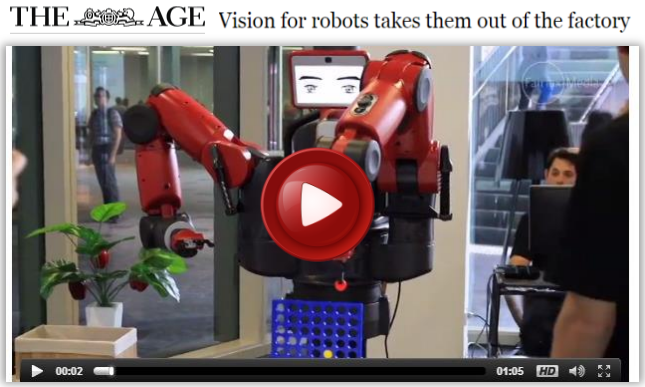
The biggest hurdle stopping robots becoming more widely used in everyday life will be the focus of a new centre for academic excellence.

The ARC Centre of Excellence in Robotic Vision has just been awarded a federal government grant of $19 million for its seven-year research program.

Professor Peter Corke leads the new $19 million ARC Centre of Excellence in Robotic Vision.

The Centre will be led by Professor Peter Corke, from QUT's Science and Engineering Faculty.

The Age: http://www.theage.com.au/



ABC news: http://www.abc.net.au/news/


New QUT research centre aims to build robots that see like human beings

By Matt Eaton and Kathy McLeish

Posted 9 Mar 2015, 5:07pm

NEWS

PHOTO: Baxter the robot plays Connect Four with researchers Dr Chris Lehnert (right) and Matt Kimboll. (Supplied: QUT)

MOOC launch

The Australian:
http://www.theaustralian.com.au/


Online courses put life in Queensland University of Technology's robot pilot

THE AUSTRALIAN | JANUARY 20, 2015 12:00AM

SAVE

Jennifer Foreshew
Technology Reporter
Sydney

THE AUSTRALIAN BUSINESS REVIEW

Peter Corke's lectures have been a worldwide hit on YouTube. Picture: Erika Fish *Source*: Supplied

ScienceAlert post: *'total reach of over 2 million people'*


Computer World Singapore:
http://www.computerworld.com.sg/

COMPUTERWORLD SINGAPORE

NEWS RESOURCE CENTRE BLOGS

Home » Industries »

MOOCs deliver robots for everyone

Adam Bender | Jan. 22, 2015

You can now study robotics completely free online!

ScienceAlert
Page Liked · 7 February

This is awesome - Queensland University of Technology (QUT) is running a free Introduction to Robotics course starting next week, and it's open to EVERYONE. All you need is a computer and a desire to learn. Spread the word and register here: http://bit.ly/1AvhpoA

Like · Comment · Share

22,856 people like this.

13,083 shares

View previous comments 6 of 1,174

Bonnie Claassen Woodruff Thanks Matt
Like · Reply · 2 hrs

Caterina Zaini Nicole Leah
Like · Reply · 2 hrs

Brian Lowe Fantastic!
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Tom Link Cheers bloke!
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Additional peer testimonials

Daniela Rus, Director, Computer Science and Artificial Intelligence Laboratory, MIT:

Peter is leading and innovating in robotics education. I am grateful to him for all his contributions to make it easier and more exciting to introduce students to a very important field. I have witnessed his passion and relentless work to create the most extraordinary textbook for robotics: Robotics, Vision, and Control. This book is truly unique. It is a broad introduction to the field. In addition to the material one would normally expect in a textbook, Peter's book has code he developed himself to help students with the "do" part of implementing the theory and algorithms. The book also includes wonderful historical stories about the scientists whose names are associated with the various topics (e.g. Newton). This book has become ***the*** *introductory textbook in robotics***.** *I know many universities where Peter's book is used as textbook.*

More recently Peter created a wildly successful MOOC – the first robotics MOOC. This was a huge amount of work, which Peter did this with his characteristic passion and concern for the student experience. The course has over 10,000 students. This is quite extraordinary. I signed up to take the course and enjoyed very much the beautifully polished and inspiring lectures. I also followed the student forum and can tell you that the excitement and energy in the forum is infectious. His passion for teaching is clear in the amount of time he has devoted to creating beautiful, extraordinary, and innovative teaching resources and mentoring of students.

Professor Peter Coaldrake, Vice-Chancellor, QUT:

Peter Corke's highly effective and engaging approach to learning and teaching is founded on his deep passion for robotics, his world-class research and a desire to make learning in robotics available to all. Peter is a champion for the teaching/research nexus, with a deep appreciation not only of the power of his research to inform his teaching but also, conversely, of the way in which learners can inspire and influence his research and teaching.

Professor Gordon Wyeth, Executive Dean, Faculty of Science and Engineering, QUT:

Peter Corke is an international leader in the education of the next generation of roboticists, bringing his extensive knowledge and experience to a broad community through accessible and engaging resources and activities. It is important to note that the material that Peter teaches is intellectually demanding; his robotics courses are full of challenging concepts and rely on the application of mathematical skills. Peter's approach is to engage students through invention, encouraging them to construct solutions to robotic problems, while providing them with the concepts they need to succeed. Students learn because they see the immediate value of the concepts and maths, rather than some notion that "this is good for you". Peter has supplied wonderful resources to take the mindless numerical work out of the maths, allowing students to deal with the concepts rather than rote skills.

For many years in his role in an industrial research organisation (CSIRO), Peter did his teaching without a classroom by providing resources that allowed the international community of learners to explore challenging concepts in robotics. The beauty of his textbook, and the significant difference to other texts, is that it allows students to prototype worked examples immediately to see the strengths and weaknesses of approaches to robotics problems. I have also personally witnessed young roboticists, now engaged in productive careers, thanking Peter for his robotics toolboxes and acknowledging how it bought them to success in their studies.

Peter continues to innovate and lead robotics education by bringing his teaching to the globe through his MOOCs. The MOOCs are structured by Peter's pedagogy of learning by doing activities, supported by beautifully crafted explanations. The associated online communities and support mechanisms provide outstanding learning experiences for budding roboticists around the globe.