

Presentation to begin

1 3 : 0 0 pm



**Wydział  
Elektryczny**

POLITECHNIKA WARSZAWSKA

[www.ee.pw.edu.pl](http://www.ee.pw.edu.pl)

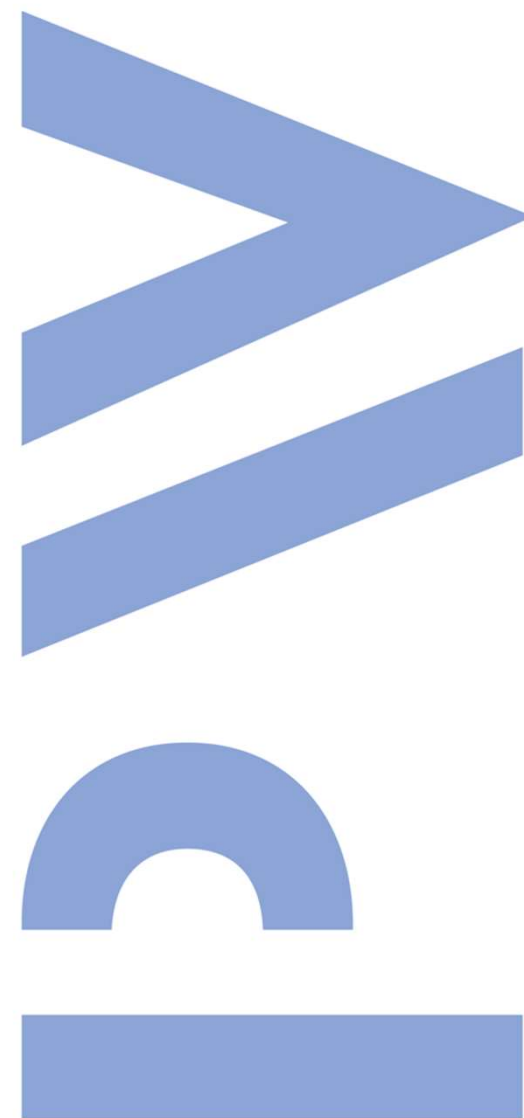
# Inżynier: najciekawszy zawód przyszłości

Część 2 z 2: Czy mówisz w języku sztucznej inteligencji?

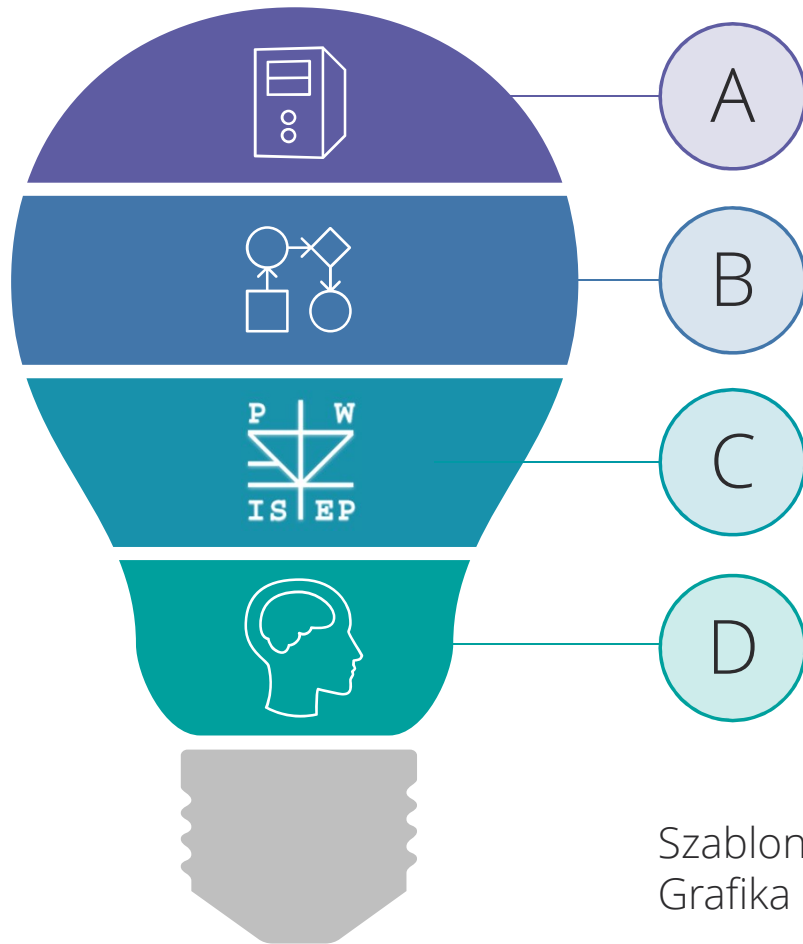
dr hab. inż. Bartłomiej Ufnalski, prof. uczelni  
Instytut Sterowania i Elektroniki Przemysłowej (ISEP)  
[www.isep.pw.edu.pl](http://www.isep.pw.edu.pl)

**Politechnika  
Warszawska**  
[www.pw.edu.pl](http://www.pw.edu.pl)

**LVI LO im. Rotmistrza Witolda Pileckiego**  
[www.56lo.waw.pl](http://www.56lo.waw.pl)  
06.06.2019



## Ogólny zarys tematyki (część 2)



A

Cyfrowe układy sterowania (digital control systems)  
Ich wszechobecność wokół nas, oraz coraz częściej na nas  
(wearables) i w nas (bionics)

B

Numeracy is the modern literacy  
A ja chcę być artystą - czy potrzebna mi do tego umiejętność  
programowania?

C

Instytut Sterowania i Elektroniki Przemysłowej  
Dlaczego warto studiować na Wydziale Elektrycznym Politechniki  
Warszawskiej

D

Ocean informacji  
Myślenie krytyczne jako kapitan naszego statku, uczenie  
maszynowe i sztuczna inteligencja jako jego oficerowie

Szablon prezentacji: [graphicriver.net/item/i9-template-system/10955645](https://graphicriver.net/item/i9-template-system/10955645).  
Grafika i fotografia: [pixabay.com](https://pixabay.com), [unsplash.com](https://unsplash.com), [flaticon.com](https://flaticon.com), [wikipedia.org](https://wikipedia.org).

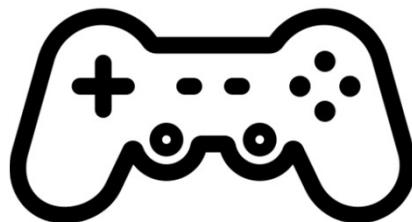
Dwa światy: analogowy i cyfrowy. Odrębne światy?





Chmura to nie tylko przestrzeń na nasze dane

Chmura obecnie to też moc obliczeniowa umożliwiającą użytkownikowi granie nawet w 4K.



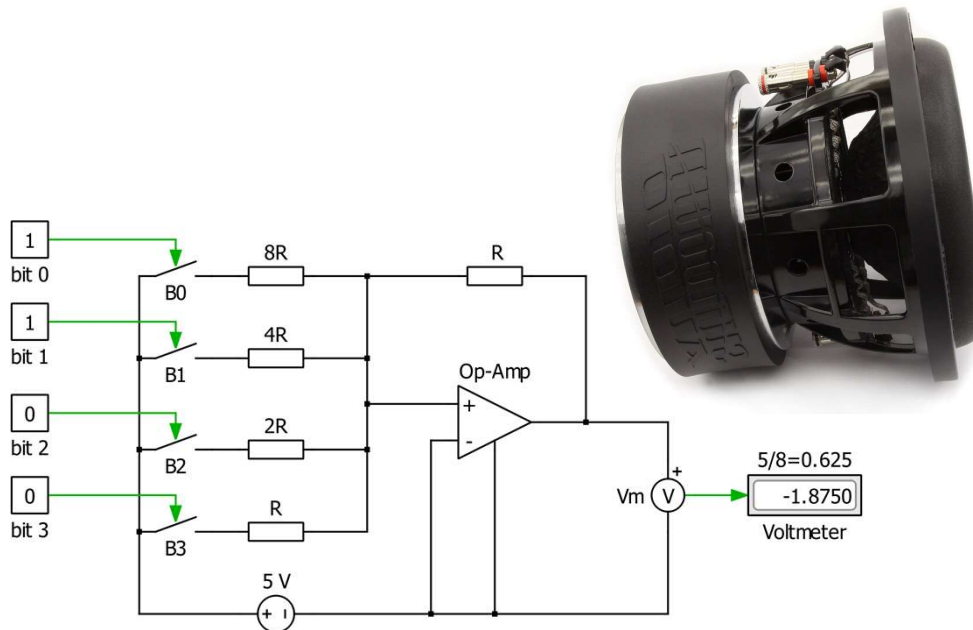
ColdFusion: Stadia – Google’s Game Changer?  
<https://www.youtube.com/watch?v=4SRJO5n5xoQ>

# Przeplatające się dwa światy: analogowy i cyfrowy

Budujemy coraz bardziej zaawansowaną cywilizację,  
aby coraz lepiej zaspokajać nasze ANLOGOWE potrzeby – świat CYFROWY  
też konsumujemy zmysłami ANALOGOWYMI

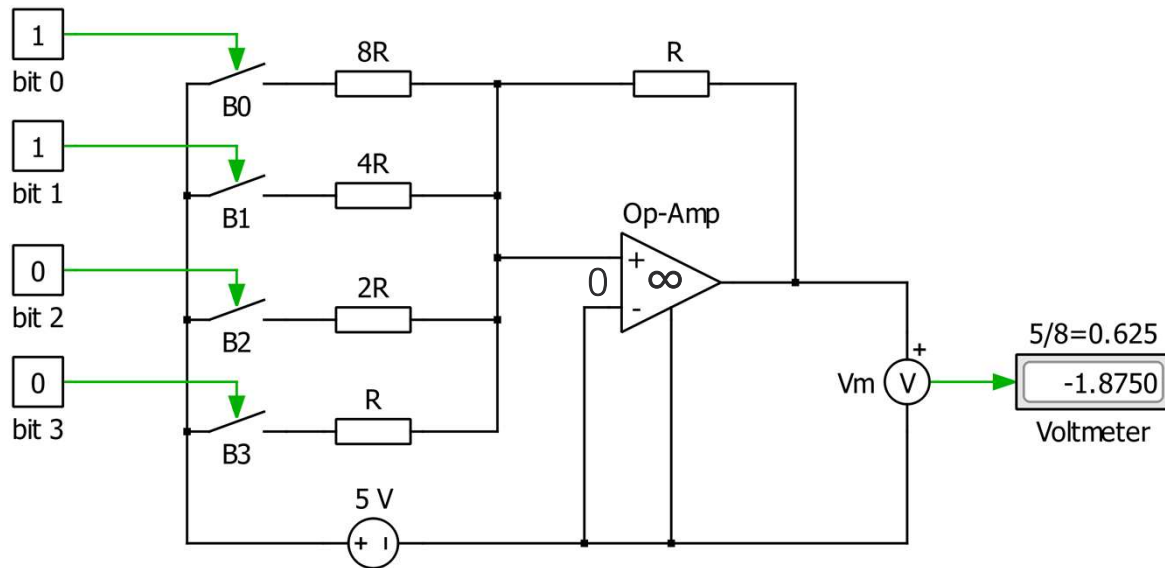


**MP3**



$5/8=0.625$   
-1.8750  
Voltmeter

A na styku tych dwóch światów mamy przetworniki analogowo-cyfrowe (ADC) i cyfrowo-analogowe (DAC)



$$U = 5V$$

$$\frac{5V}{8} = -0,625V$$

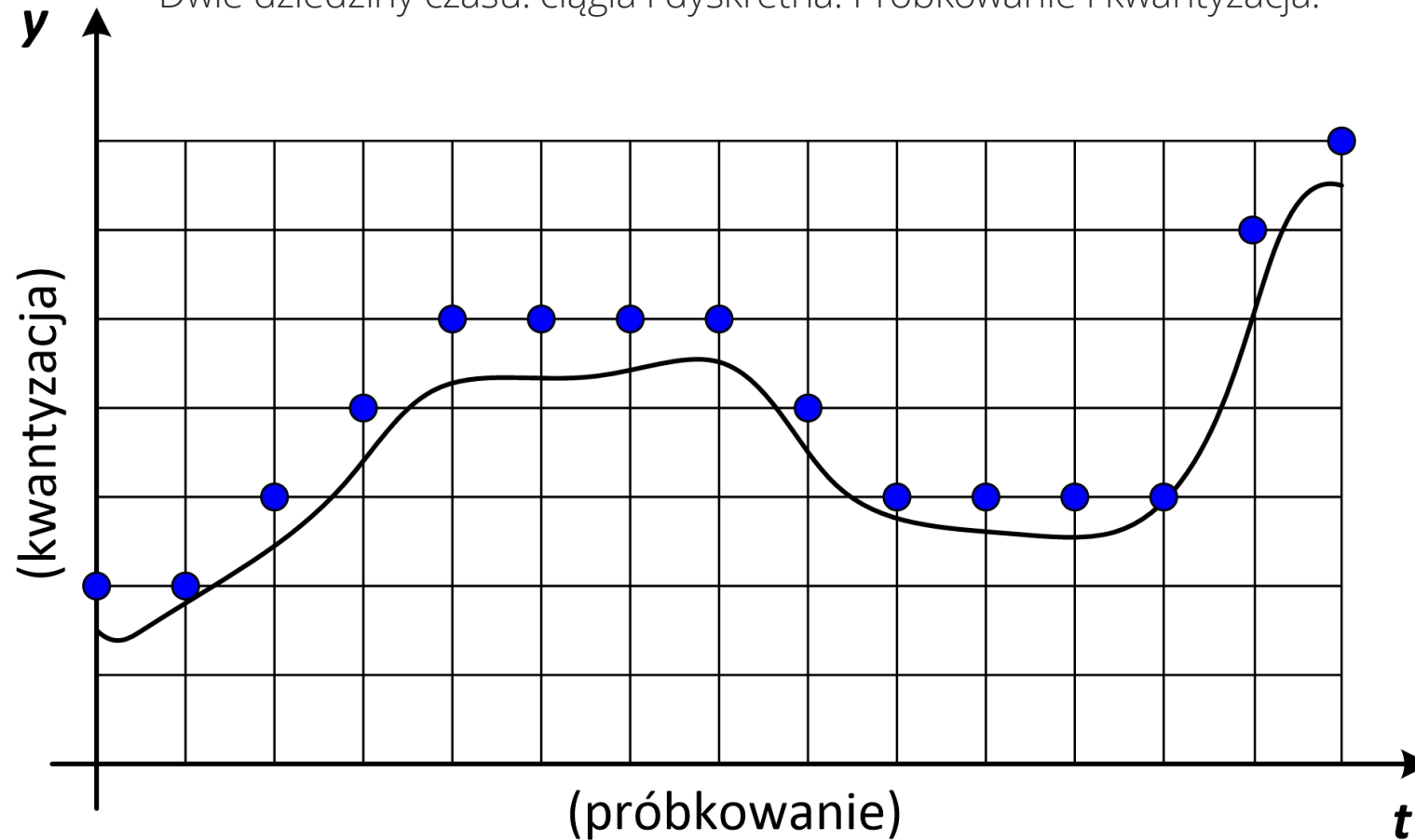
$$I = I_1 + I_2 + I_4 + I_8 = B_0 \frac{U}{8R} + B_1 \frac{U}{4R} + B_2 \frac{U}{2R} + B_3 \frac{U}{R}$$

$$U_{wy} = -RI = -U \left( \frac{B_0}{8} + \frac{B_1}{4} + \frac{B_2}{2} + \frac{B_3}{1} \right) = -\frac{U}{8} (B_0 2^0 + B_1 2^1 + B_2 2^2 + B_3 2^3)$$

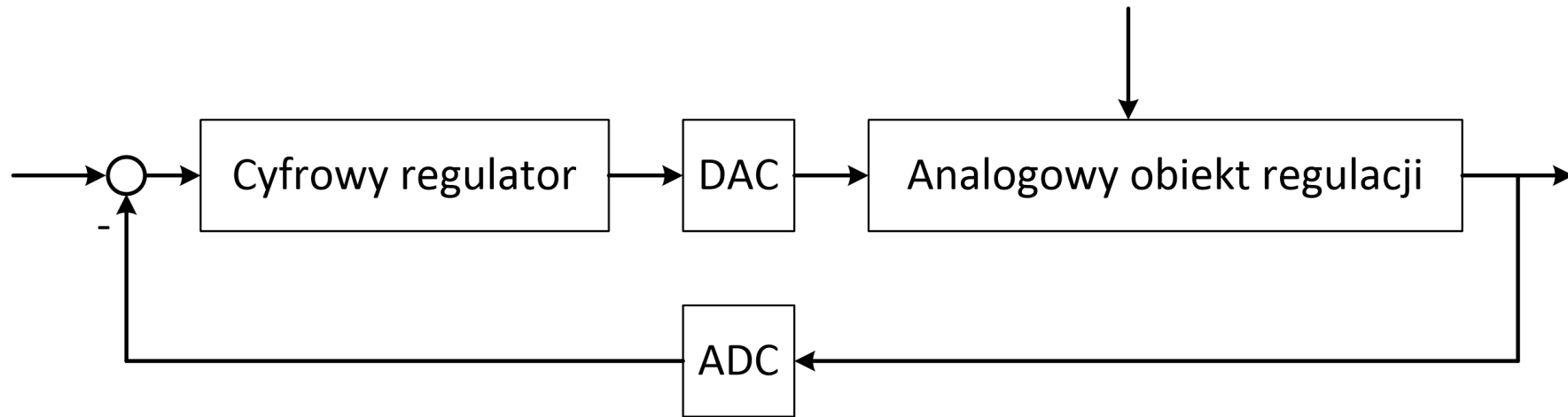
A kto ma pomysł na takie rozbudowanie powyższego układu, aby możliwa była realizacja zadania przetwarzania sygnału analogowego na cyfrowy?

# Przeplatające się dwa światy: analogowy i cyfrowy

Dwie dziedziny czasu: ciągła i dyskretna. Próbkowanie i kwantyzacja.

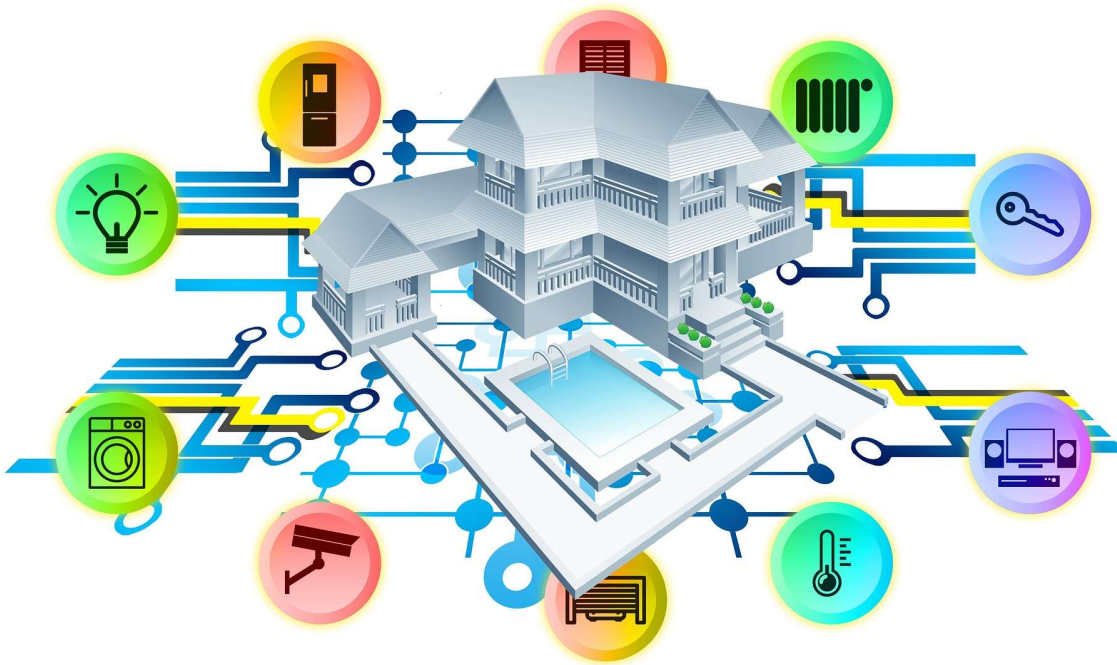


## Zamknięty układ regulacji



Understanding Control Systems by Mathworks  
<https://www.youtube.com/watch?v=FurC2unHeXI>  
Control lectures by Brian Douglas  
<https://www.youtube.com/user/ControlLectures>

Gdzie stosujemy układy sterowania z cyfrowymi regulatorami ze sprzężeniem zwrotnym? Wszędzie! ;) Wokół nas, na nas i w nas.



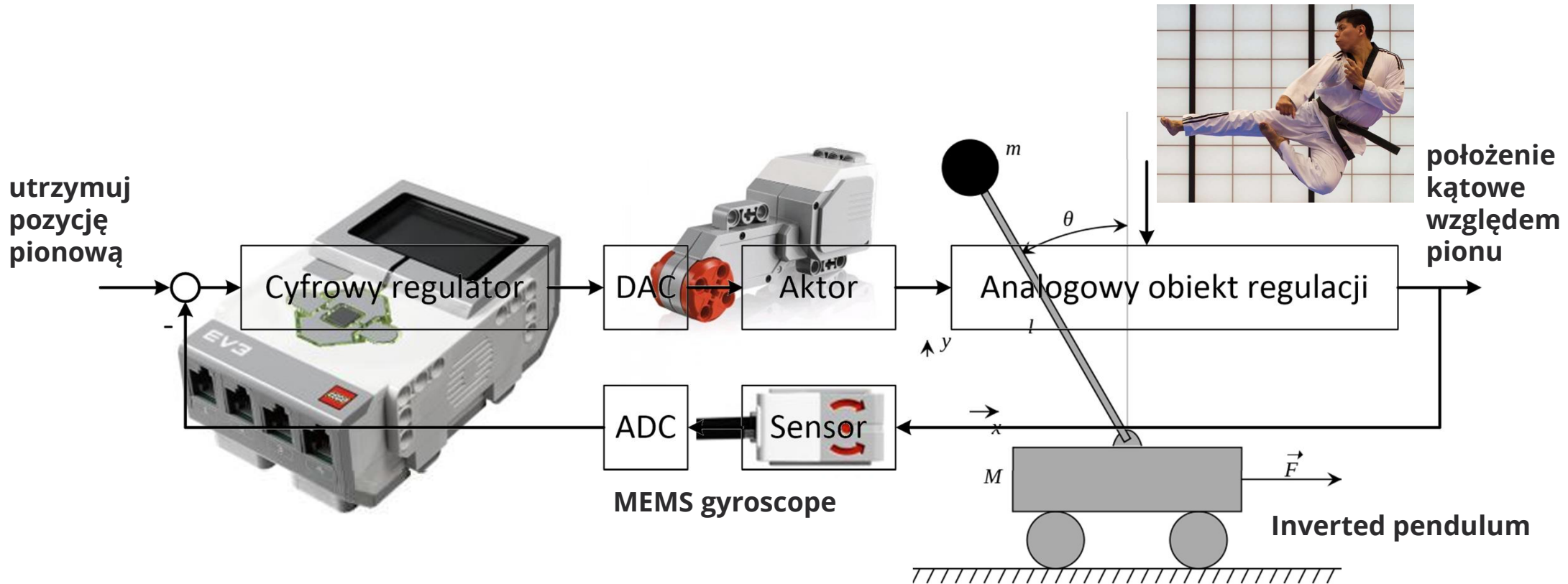
Source: wikipedia.org  
See also: waymo.com



Hugh Herr: How we'll become cyborgs and extend human potential, TED 2018  
[https://www.ted.com/talks/hugh\\_herr\\_how\\_we\\_ll\\_become\\_cyborgs\\_and\\_extend\\_human\\_potential](https://www.ted.com/talks/hugh_herr_how_we_ll_become_cyborgs_and_extend_human_potential)  
Raffaello D'Andrea: The astounding athletic power of quadcopters, TED 2013  
[https://www.ted.com/talks/raffaello\\_d\\_andrea\\_the\\_astounding\\_athletic\\_power\\_of\\_quadcopters](https://www.ted.com/talks/raffaello_d_andrea_the_astounding_athletic_power_of_quadcopters)



# Zamknięty układ regulacji na przykładzie GyroBoy'a



Some spectacular closed-loop motion control systems:

<https://www.youtube.com/watch?v=LikxFZZO2sk> (Boston Dynamics)

<https://global.yamaha-motor.com/showroom/motobot> (YAMAHA MOTOBOT)

<https://www.youtube.com/watch?v=8BtDuzu2Wel> (Ballbot by Carnegie Mellon University)



# Numeracy is the modern literacy

A ja chcę być artystą – czy potrzebna mi do tego umiejętność programowania?



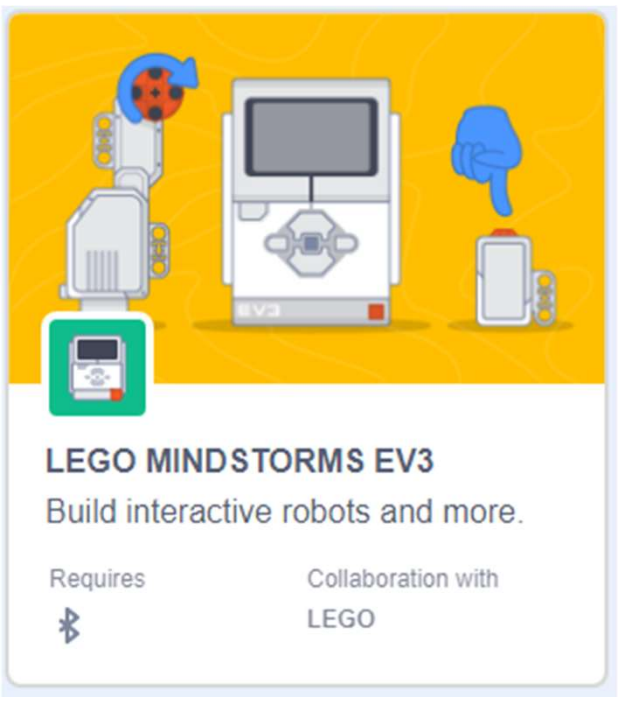
Świat mówi do Was obecnie językami programowania – warto umieć mu odpowiedzieć :) Zobaczcie o ile poszerzyły się Wam horyzonty dzięki znajomości języka angielskiego. Daliście sobie w ten sposób praktycznie nieograniczoną możliwość komunikowania się ze światem analogowym (bloodware, wetware). Rozwijając umiejętność porozumiewania się w językach świata cyfrowego stwarzacie sobie niemalże nieograniczone możliwości spełniania swoich marzeń. A przy okazji możecie oprogramować np. GyroCopernicus'a.

Probably the three most important literacies nowadays: technological literacy,  
data literacy  
and human literacy.



Once Upon an Algorithm: How Stories Explain Computing by Martin Erwig, 2018

# Programming for your younger siblings (ca. 8–12 year olds)



Scratch  
<https://scratch.mit.edu/>

```
LEGO EV3 ✓  
Motion  
motor A turn this way for 1 s  
motor A turn that way for 1 s  
motor A set power 100 %  
motor A position  
Sensing  
when button 1 pressed  
Operators  
when distance < 5  
when brightness < 50  
My Blocks  
button 1 pressed?  
LEGO EV3  
distance  
brightness  
beep note 60 for 0.5 secs
```

```
when button 1 pressed  
motor B set power 25 %  
set left_wheel_position to motor B position  
show variable left_wheel_position  
repeat until left_wheel_position > 180  
motor B turn this way for 0.1 seconds  
set left_wheel_position to motor B position  
beep note 60 for 0.5 secs
```

The image shows the Scratch code editor interface. On the left is a 'Code' tab with a 'LEGO EV3' block palette containing various motion, sensing, and control blocks. The main workspace shows a script starting with 'when button 1 pressed', followed by 'motor B set power 25 %', 'set left\_wheel\_position to motor B position', 'show variable left\_wheel\_position', a 'repeat until' loop where 'left\_wheel\_position > 180', 'motor B turn this way for 0.1 seconds', and 'set left\_wheel\_position to motor B position'. The script ends with 'beep note 60 for 0.5 secs'.

# Zmiana retoryki --> zmiana sposobu myślenia

## Język angielski i programowanie jest dla wszystkich

**Angielski** jako lingua franca współczesnego świata przestaje być traktowany jak język obcy. Jeżeli pada pytanie o znajomość języków obcych, to często pytający ma na myśli Waszą znajomość języków innych niż polski i angielski. Angielski jest dla wszystkich! A jako języki obce mamy np. **hiszpański** i **chiński**.

Podobnie umiejętność programowania/kodowania przestaje być domeną jedynie informatyków/programistów/deweloperów/koderów. **Kod** to lingua franca współczesnego świata cyfrowego. Programowanie jest dla wszystkich! Nawet dla artystów! Zaczniście przygodę od np. **Java**, **C/C++/C#** lub **Python**.

```
hello_python.py x
1 user_name = input("What's your name? ")
2 print(f"Hello {user_name}! I'm Python. Let's code!")
3 |
```

```
PS C:\Dokumenty_Bartqa\Python_Ex> python hello_python.py
What's your name? Bartek
Hello Bartek! I'm Python. Let's code!
PS C:\Dokumenty_Bartqa\Python_Ex> |
```



Python Software Foundation  
[www.python.org](http://www.python.org)



Visual Studio Code  
<https://code.visualstudio.com>



Learn Python 3 the Hard Way: A Very Simple Introduction to the Terrifyingly **Beautiful World of Computers and Code** by Zed Shaw, 2017  
<https://learncodethehardway.org/python>



# You can program your LEGO Mindstorms EV3 using Python



Option one: ev3dev2

```
leds.all_off()
sound.speak("Eyem ready", espeak_opts=opts+'en+f2', play_type=1)
while not ts.is_pressed:
    ir.process()
    if button_pressed==TOP_LEFT:
        steer_pair.on(steering=0, speed=40)
    elif button_pressed==BOTTOM_LEFT and us.distance_centimeters>20:
        steer_pair.on(steering=0, speed=-40)
    elif button_pressed==TOP_RIGHT:
        steer_pair.on(steering=90, speed=30)
    elif button_pressed==BOTTOM_RIGHT:
        steer_pair.on(steering=-90, speed=30)
    else:
        steer_pair.off()
```



EV3dev

<https://www.ev3dev.org/>



EV3 python

<http://www.ev3python.com>

# You can program LEGO Mindstorms EV3 using MicroPython

Option two: pybricks (MicroPython)

<https://micropython.org>

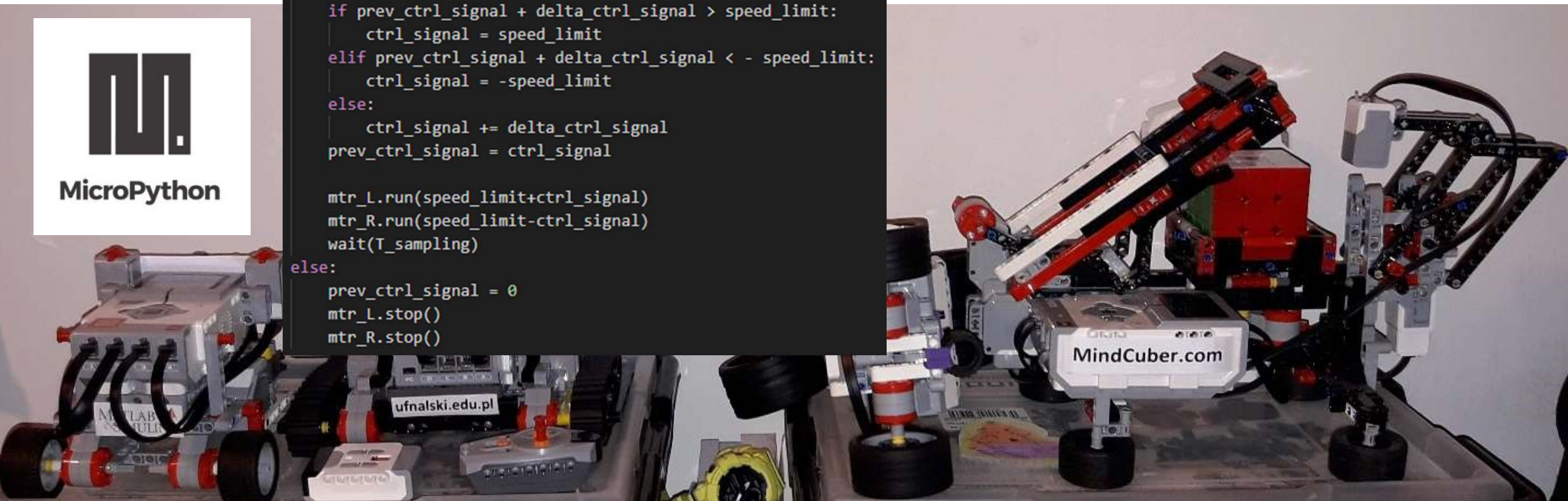
<https://education.lego.com/en-us/support/mindstorms-ev3/python-for-ev3>

```
if LETSGO:
    ctrl_error = cs_L.reflection() - cs_R.reflection()
    # PI controller with anti-windup algorithm (clamping)
    delta_ctrl_signal = (k_P + T_sampling * k_I) * \
        ctrl_error - k_P * prev_ctrl_error
    prev_ctrl_error = ctrl_error
    if prev_ctrl_signal + delta_ctrl_signal > speed_limit:
        ctrl_signal = speed_limit
    elif prev_ctrl_signal + delta_ctrl_signal < - speed_limit:
        ctrl_signal = -speed_limit
    else:
        ctrl_signal += delta_ctrl_signal
    prev_ctrl_signal = ctrl_signal

    mtr_L.run(speed_limit+ctrl_signal)
    mtr_R.run(speed_limit-ctrl_signal)
    wait(T_sampling)
else:
    prev_ctrl_signal = 0
    mtr_L.stop()
    mtr_R.stop()
```

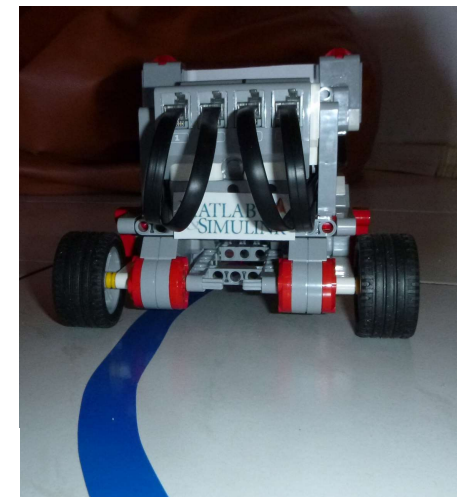
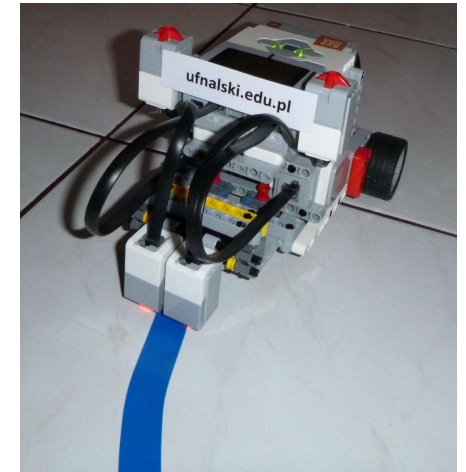
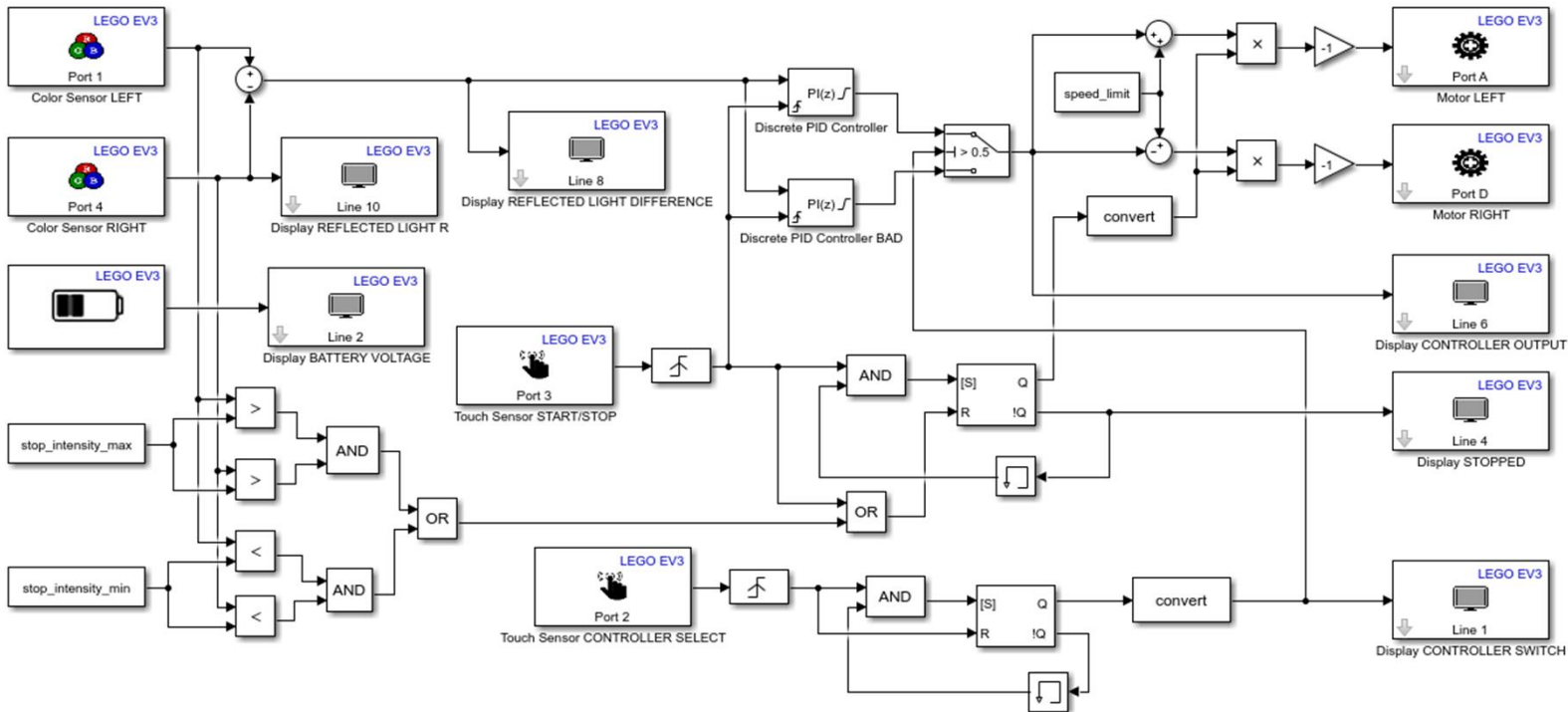


MicroPython





# You can program LEGO Mindstorms EV3 using Matlab/Simulink

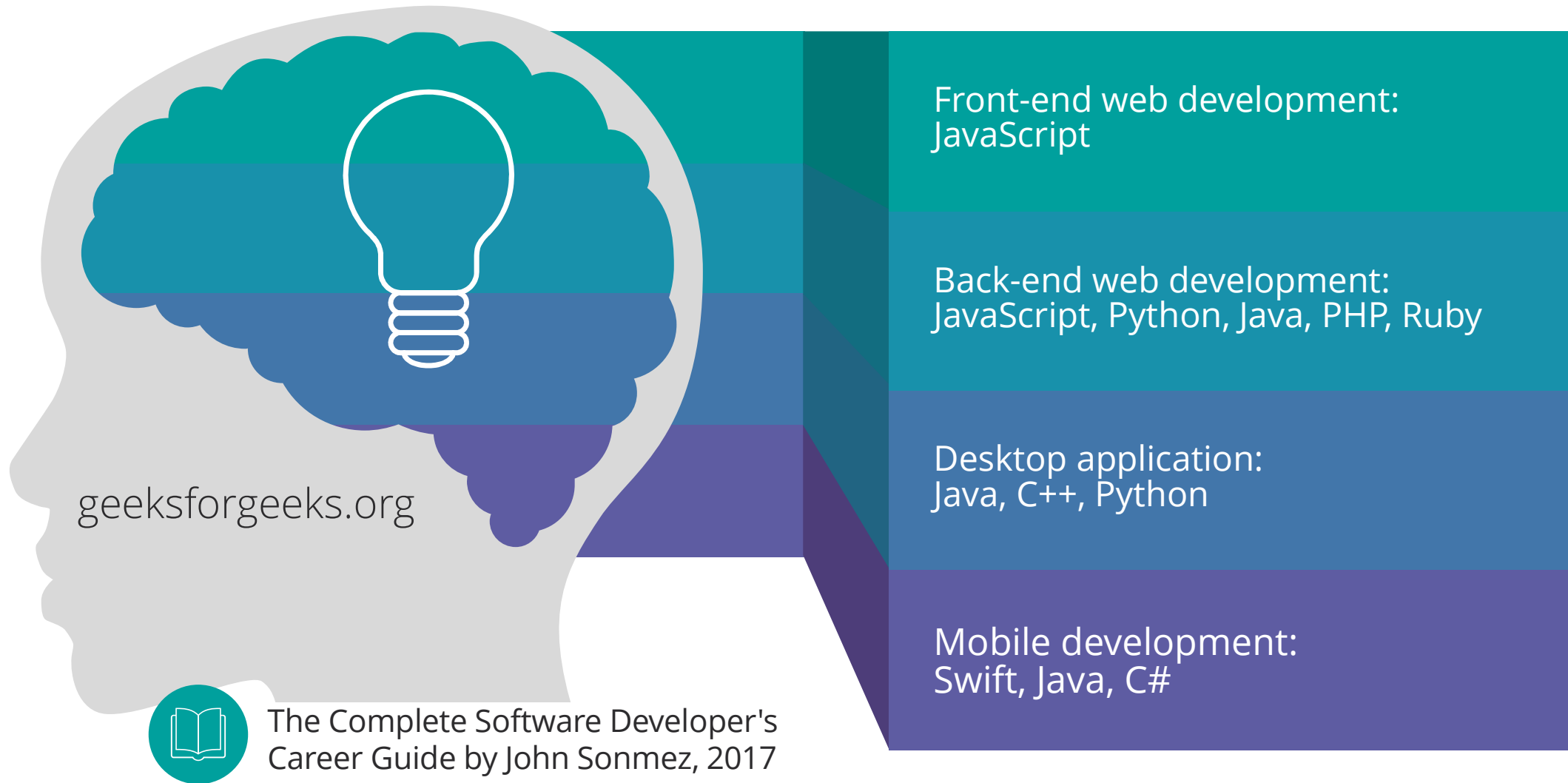


LEGO MINDSTORMS EV3 Support from Simulink

<https://www.mathworks.com/hardware-support/lego-mindstorms-ev3-simulink.html>

Matlab/Simulink for your school for only 399 EUR + VAT.  
Contact [Remigiusz.Lipiec@ont.com.pl](mailto:Remigiusz.Lipiec@ont.com.pl) to get the license.

# Programming languages



# Programming languages

Mathematics:  
Matlab, Mathematica, Scilab, Octave

Data science, machine learning, AI:  
R, SQL, Python, Ruby, Scala

Control system design:  
Matlab & Simulink, LabVIEW

Digital Signal Controller, FPGA (embedded systems):  
C, VHDL, Verilog

(the list is by no means even close to complete)

# Programming languages

1. Python	  
2. C++	  
3. Java	  
4. C	  
5. C#	  

Digital arts and typesetting:  
processing.org, LaTeX (e.g. MiKTeX)

LEGO Mindstorms EV3:  
EV3-G (LabVIEW), Matlab&Simulink

Robotics and AI:  
ROS.org, OpenAI, Dataiku

Dzieciaki i młodsza młodzież:  
Scratch



<http://www.legoengineering.com/alternative-programming-languages>

<https://scratch.mit.edu/download>

<https://spectrum.ieee.org/at-work/innovation/the-2018-top-programming-languages>

<https://miktex.org/> + [www.xm1math.net/texmaker](http://www.xm1math.net/texmaker) or [www.texstudio.org](http://www.texstudio.org)

<https://www.overleaf.com>

And now let's play with GyroBoy (an inverted pendulum)



<https://education.lego.com/en-us/support/mindstorms-ev3/building-instructions#program-core>

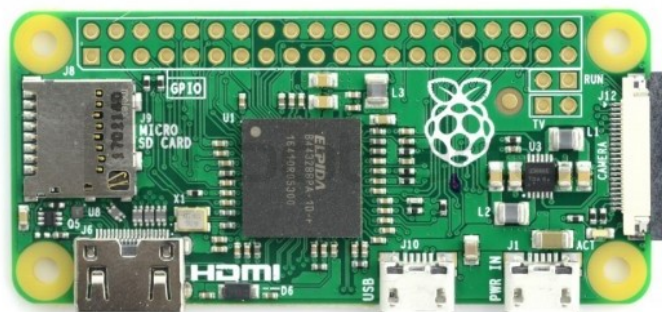


<https://www.mathworks.com/matlabcentral/fileexchange/60322-gyroboy-self-balancing-two-wheel-robot-segway-based-on-lego-ev3>

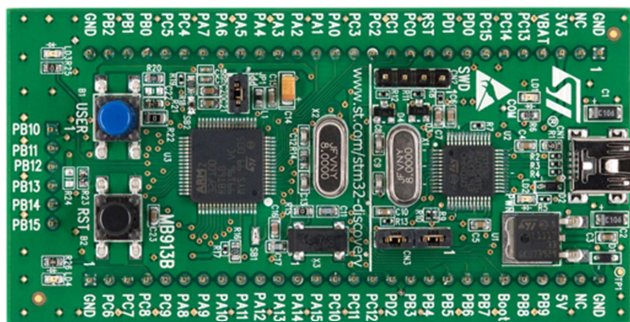


Jak zacząć przygodę z automatyką jeszcze przed maturą – przykładowe zestawy ewaluacyjne/edukacyjne do nauki programowania w automatyce i robotyce w cenie dwóch pizz (koszt wejścia 60 PLN)

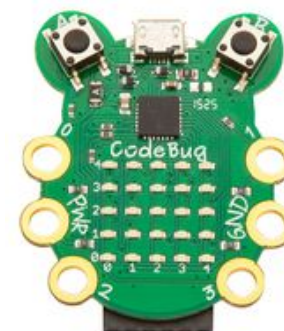
Raspberry Pi: od 25 PLN



STM32VLDISCOVERY: 65 PLN



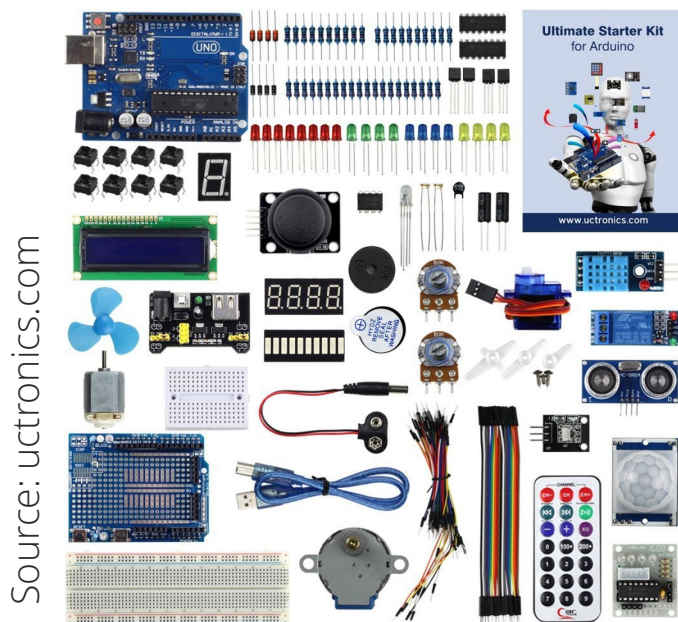
CodeBug: 75 PLN



Play with microcontrollers! It's a no-brainer! Learn to speak their language! Visit e.g. [www.tme.eu](http://www.tme.eu), [farnell.com](http://farnell.com) or [digikey.pl](http://digikey.pl) (thousands of evaluation kits!).



# Jak zacząć przygodę z automatyką jeszcze przed maturą – przykładowe zestawy ewaluacyjne/edukacyjne do nauki programowania w automatyce i robotyce w cenie pięciu pizz (150 PLN)



Słowa kluczowe:

zestaw rozwojowy  
zestaw uruchomieniowy  
zestaw startowy  
komputer jednocukładowy  
mikrokontroler  
system wbudowany  
embedded system  
eval kit  
evaluation kit  
evaluation board  
starter kit



Na przykład: [uctronics.com](http://uctronics.com), [conrad.pl](http://conrad.pl), [botland.com.pl](http://botland.com.pl), [sklep.avt.pl](http://sklep.avt.pl), [kamami.pl](http://kamami.pl), [diolut.pl](http://diolut.pl), [aliexpress.com](http://aliexpress.com)  
Przykładowe porównanie: <https://www.robocamp.pl/pl/test-narzedzi-nauczania-robotyki-powyzej-10/>



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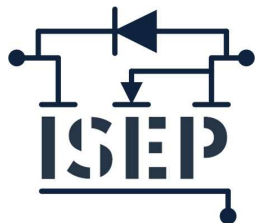
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Instytut Elektroenergetyki  
<http://www.iem.pw.edu.pl/>

**IETiSIP**

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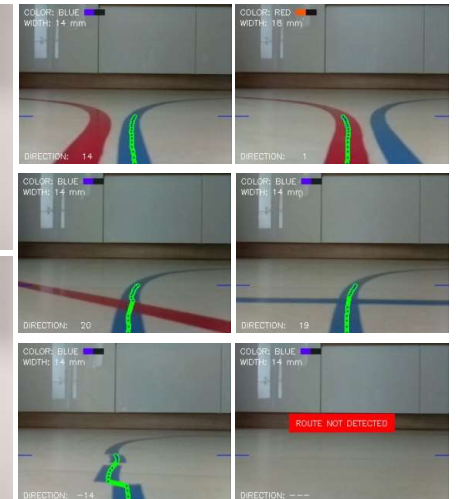
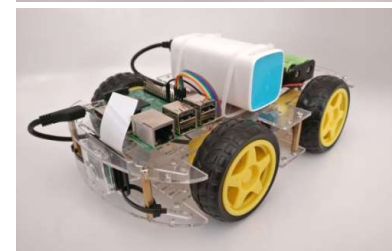
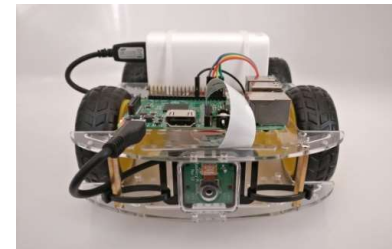
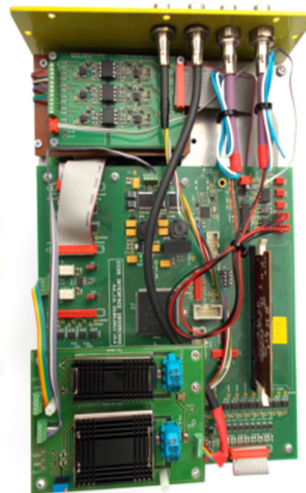
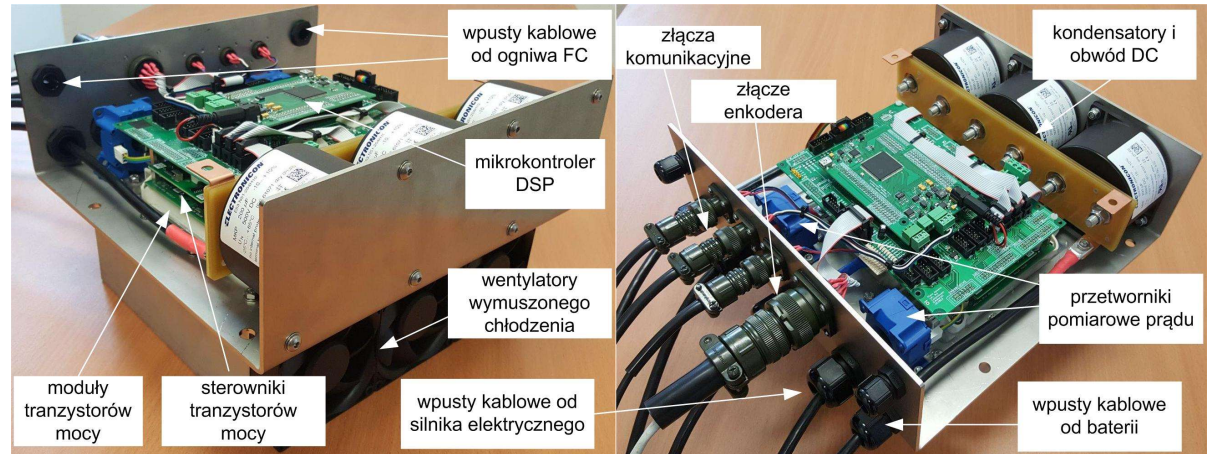
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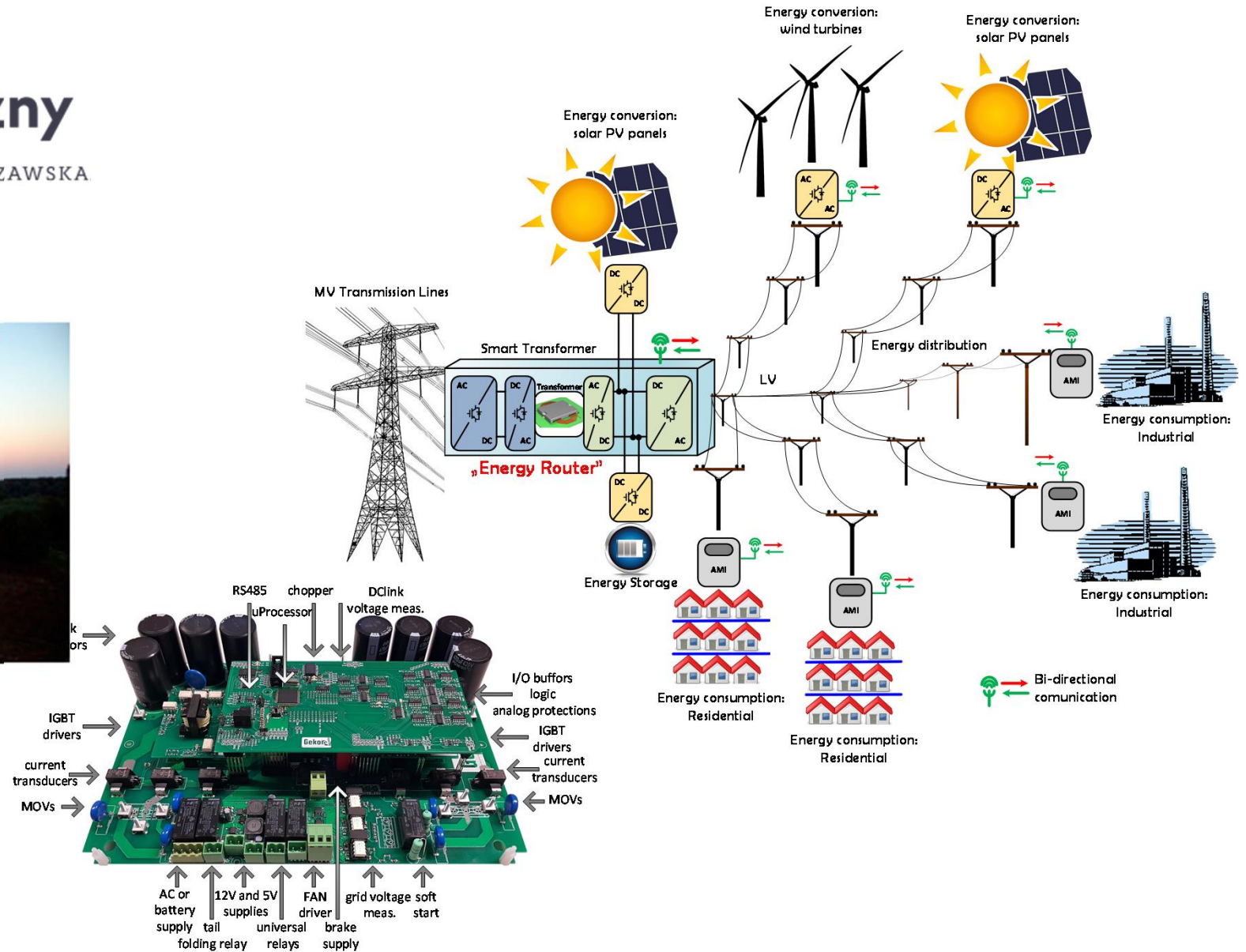
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<https://pl-pl.facebook.com/adekkolo/>





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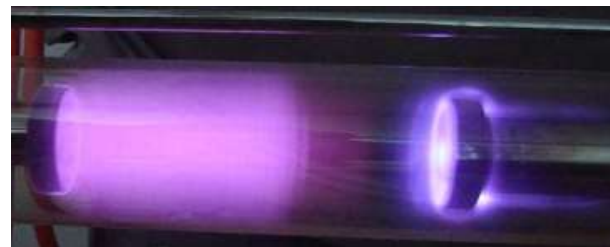
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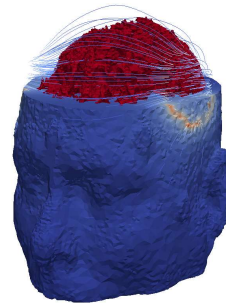
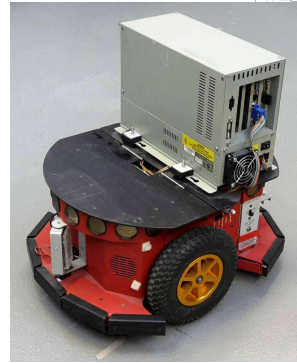
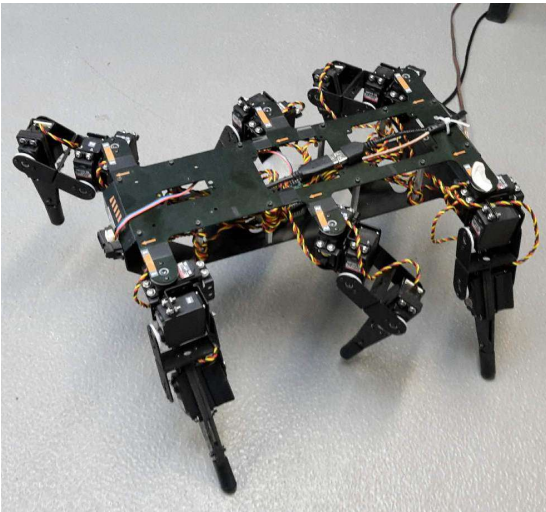
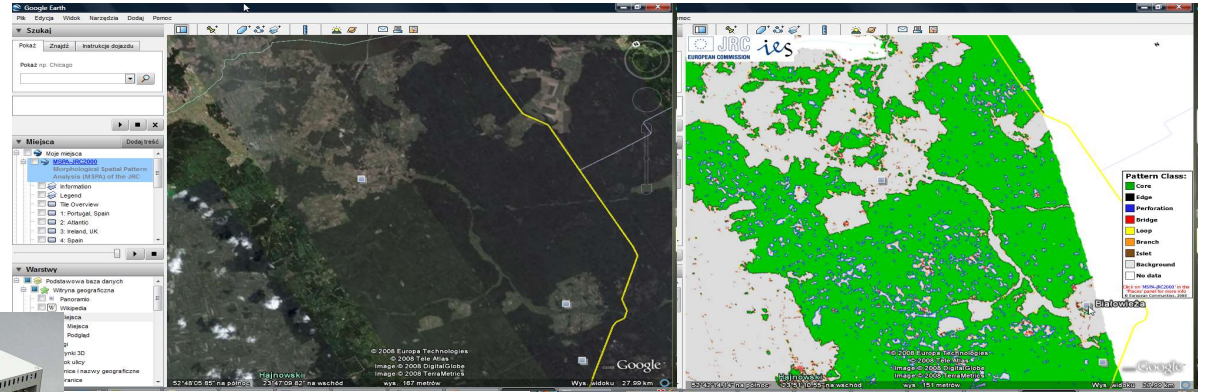




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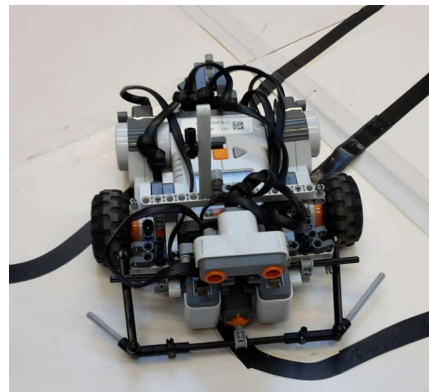
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[www.pw.edu.pl](http://www.pw.edu.pl)

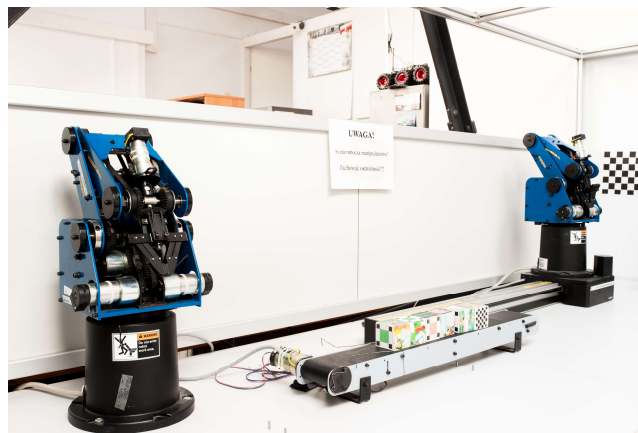
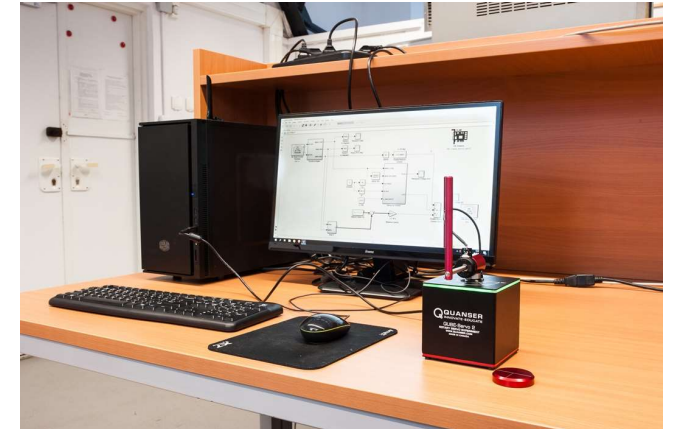
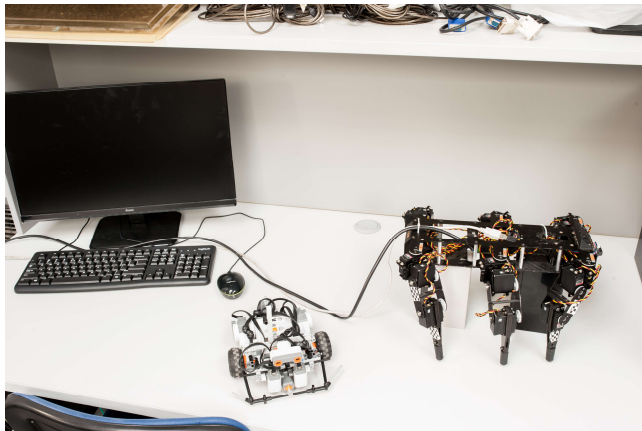




# Wydział Elektryczny

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# Politechnika Warszawska

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# Critical thinking skills wanted more than ever!!!



free energy, free internet, free wifi, magnet motor, quantum energy generator

<https://revolution-green.com/yildiz-magnetic-motor-update/>

[http://arizonaenergy.org/News\\_13/News\\_Jan13/AssistantProfessorPresentsScientificModelforYildizMagnetMotor.html](http://arizonaenergy.org/News_13/News_Jan13/AssistantProfessorPresentsScientificModelforYildizMagnetMotor.html)

[www.borderlands.de/Links/ModelingYildizMotor\\_v01.pdf](http://www.borderlands.de/Links/ModelingYildizMotor_v01.pdf)

<https://www.youtube.com/watch?v=40ld-JeEbsA> (8 mln views in 30 days!!!)

One of the comments: **Spreading disinformation to children is a crime against humanity.**



Post-Truth by Evan Davis, 2017

Post-Truth by Lee C. McIntyre, 2018

The godfather of fake news by Anisa Subedar, 2018

[https://www.bbc.co.uk/news/resources/idt-sh/the\\_godfather\\_of\\_fake\\_news](https://www.bbc.co.uk/news/resources/idt-sh/the_godfather_of_fake_news)

# Pseudoscience , cargo cult science and fake science

Never say that you'll give a talk unless you know clearly what you're going to talk about and more or less what you're going to say.  
RICHARD P. FEYNMAN



See: phrenology

Is most published research wrong?

<https://www.youtube.com/watch?v=42QuXLucH3Q>

Fake science factory

[https://www.youtube.com/watch?v=ras\\_VYgA77Q](https://www.youtube.com/watch?v=ras_VYgA77Q)

<https://www.youtube.com/watch?v=nkW9aS2EeIE>

Psychology Gone Wrong: The Dark Sides of Science and Therapy by Tomasz Witkowski and Maciej Zatonski, 2015

Psychology Led Astray: Cargo Cult in Science and Therapy by Tomasz Witkowski, 2016

[www.tomaszwitkowski.pl](http://www.tomaszwitkowski.pl)

<http://calteches.library.caltech.edu/51/2/CargoCult.pdf>



# Sprawdzam.



The Big Short by Michael Lewis, 2010

<https://www.audible.co.uk/pd/The-Big-Short-Audiobook/B004FTZ69C>



The Big Short by Adam McKay, 2016

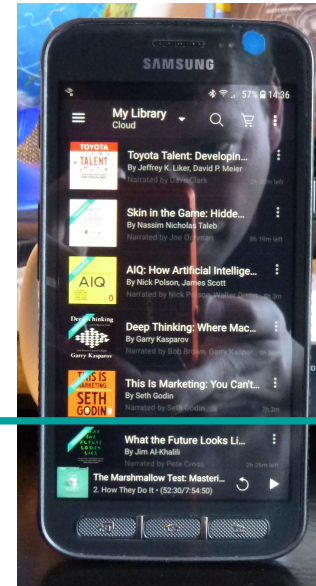
<https://www.amazon.co.uk/Big-Short-DVD-Brad-Pitt/dp/B01AD980BS>

Work-life balance? Or maybe mind, body and soul balance?  
Do what you love, and you'll never have to work a day in your life?  
Or maybe do what you're good at and the money will follow?

body



[www.greyp.com](http://www.greyp.com)



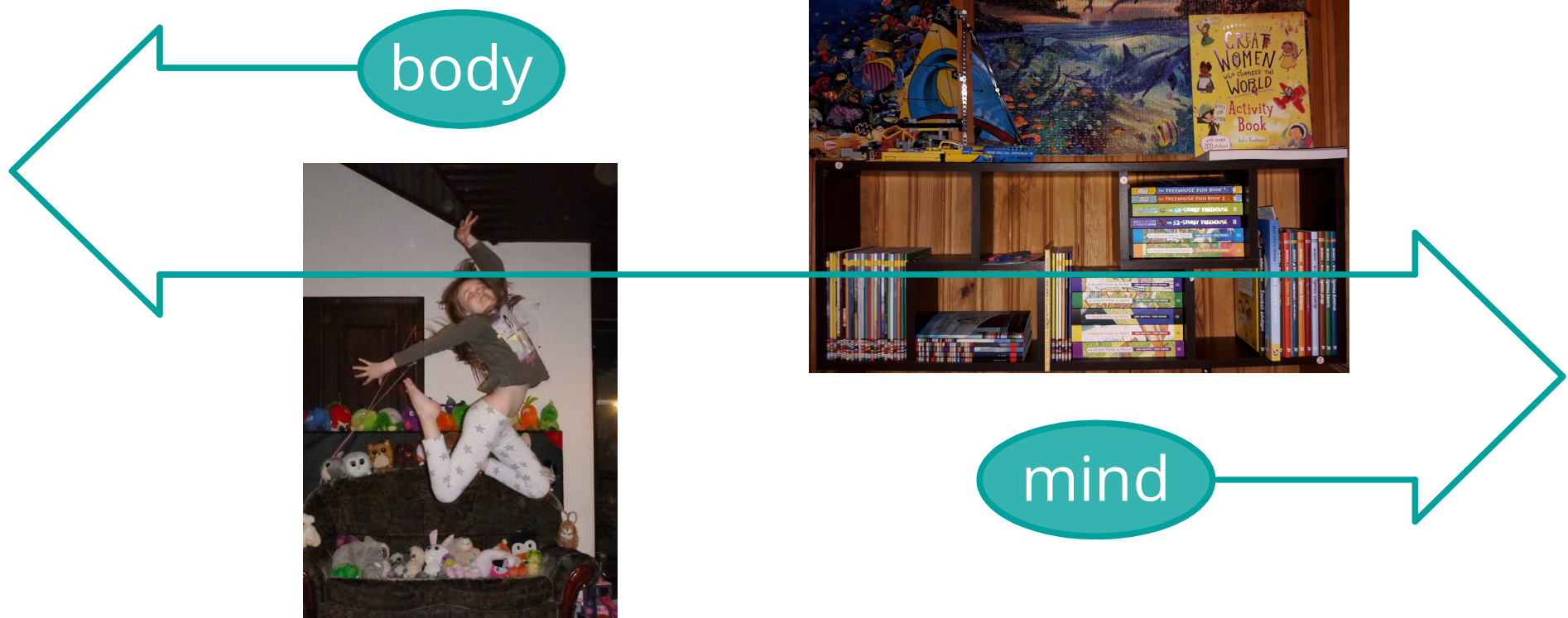
[www.audible.co.uk](http://www.audible.co.uk)

mind

Study-life balance? Or maybe mind, body and soul balance?

Find your element and studying will blend with your life.

We ALL learn ALL the time. The funny thing is that the most successful learners out there rarely call it learning.





I highly recommend you read (or listen to) also the following books:



**TED Talks** by Chris Anderson, 2016  
The Official TED Guide to Public Speaking



**Our Iceberg is Melting** by John Kotter and  
Holger Rathgeber, 2006  
Changing and Succeeding Under Any Conditions



**A Conversation About Economics** by Richard  
Werner, 2013  
Changing and Succeeding Under Any Conditions



**You, Your Child and School** by Sir Ken  
Robinson and Lou Aronica, 2018  
Navigate Your Way to the Best Education



**Talking to My Daughter About the Economy**  
by Yanis Varoufakis, 2017  
A Brief History of Capitalism



**Richard Dawkins' letter to his 10 year old  
daughter**, 2004  
(how to warn your child about this irrational world)



**Astrophysics for Young People in a  
Hurry** by Neil Degraase Tyson, 2019



**Deep Work** by Cal Newport, 2016  
Rules for Focused Success in a  
Distracted World



**Hyperfocus** by Chris Bailey, 2018  
Rules for Focused Success in a  
Distracted World



**Digital Minimalism** by Cal Newport,  
2019  
On Living Better with Less Technology



**The Laws of Medicine** by Siddhartha  
Mukherjee, 2015  
Field Notes From an Uncertain Science



**Small Change** by Dan Ariely and Jeff  
Kreisler, 2017  
Money Mishaps and How to Avoid Them

And if you are into algorithms, don't miss the fact that

# Data has a better idea

**Artificial Unintelligence** by Meredith Broussard, 2018  
How Computers Misunderstand the World

**Life 3.0** by Max Tegmark, 2018  
Being Human in the Age of Artificial Intelligence

**Weapons of Math Destruction** by Cathy O'Neil, 2016  
How Big Data Increases Inequality and Threatens Democracy

**Prediction Machines** by Ajay Agrawal, Joshua Gans and  
Avi Goldfarb, 2018  
The Simple Economics of Artificial Intelligence

**The Deep Learning Revolution** by Terrence J. Sejnowski, 2019  
Artificial Intelligence Meets Human Intelligence

**The Master Algorithm** by Pedro Domingos, 2015  
How the Quest for the Ultimate Learning Machine Will  
Remake Our World

**Algorithms to Live By** by Brian Christian  
and Tom Griffiths, 2017  
The Computer Science of Human Decisions



And if you are into algorithms, don't miss the fact that

# Data has a better idea

**A Field Guide to Lies and Statistics** (a.k.a. **Weaponized Lies**) by Daniel J. Levitin, 2017

A Neuroscientist on How to Make Sense of a Complex World (a.k.a. How to Think Critically in the Post-Truth Era)

**The Four** by Scott Galloway, 2017

The Hidden DNA of Amazon, Apple, Facebook and Google

**Hello World** by Hannah Fry, 2018

How to be Human in the Age of the Machine

**Human + Machine** by Paul R. Daugherty and H. James Wilson, 2018

Reimagining Work in the Age of AI

**Everybody Lies** by Seth Stephens-Davidowitz, 2017

Big Data, New Data, and What the Internet Can Tell Us About Who We Really Are

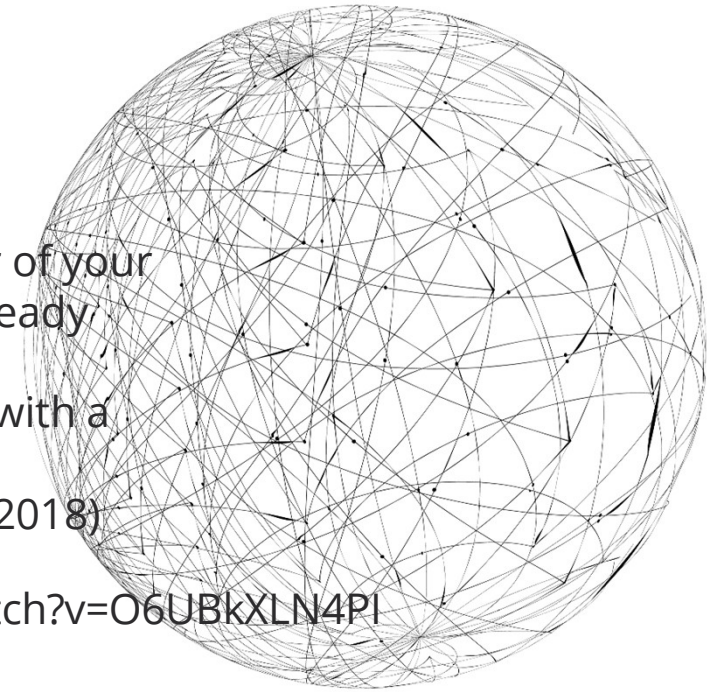
**Outnumbered** by David Sumpter, 2018

From Facebook and Google to Fake News and Filter-bubbles – The Algorithms That Control Our Lives

# Too many books too choose from? Too many topics mentioned in the presentation? Keep calm and apply philosophy and math!

My five not-so-easy steps:

1. Connect the dots.
2. Determine the big rocks of your life.
3. Apply theory of early stopping, i.e. be an effective administrator of your limited time and choose the very first option better than the already examined 37% of all options presented to you.
4. Remember that knowledge is always conditional – if presented with a new piece of information, use Bayesian reasoning.
5. Don't be afraid of being wrong. („That was a perfect fail.” ~Julia, 2018)



Dots by Włodek Markowicz, 2015: <https://www.youtube.com/watch?v=O6UBkXLN4PI>  
Interview with Simon Sinek on Inside Quest by Tom Bilyeu, 2014



First Things First by Stephen R. Covey et al., 1994

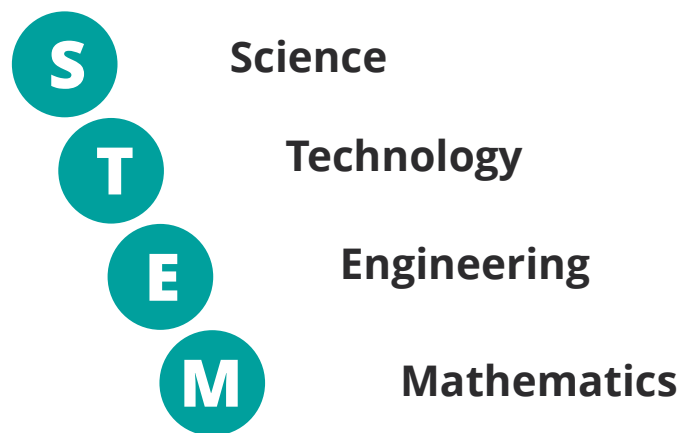


Optimal stopping: [https://en.wikipedia.org/wiki/Optimal\\_stopping](https://en.wikipedia.org/wiki/Optimal_stopping)  
Secretary problem: [https://en.wikipedia.org/wiki/Secretary\\_problem](https://en.wikipedia.org/wiki/Secretary_problem)  
Monty Hall problem: [https://en.wikipedia.org/wiki/Monty\\_Hall\\_problem](https://en.wikipedia.org/wiki/Monty_Hall_problem)



## Dlaczego jestem takim orędownikiem kształcenia w STEM?

Ok. 1870 roku połowa populacji USA pracowała w rolnictwie. Obecnie jest to poniżej 2%. Te 48% populacji nie stało się bezrobotne. Kombajny nie są naszym wrogiem, ale przyjacielem. Analogicznie uczenie maszynowe i sztuczna inteligencja nie spowoduje bezrobocia – jedynie wyręczy nas w żmudnych pracach. Moim zdaniem ok. 2060 połowa populacji będzie zatrudniona w STEM lub jego pochodnych, dlatego promujcie STEM zarówno wśród Waszych rówieśników, jak i Waszego młodszego rodzeństwa! Wiem, wydaje się to abstrakcyjne – tak samo jednak abstrakcyjne dla rolnika z 1870 było stwierdzenie, że za ok. 140 lat liczba osób zatrudnionych w jego sektorze zmaleje 25-krotnie, bo przecież jeść musimy wszyscy.





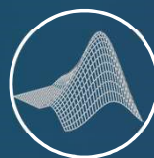
# Wydział Elektryczny

POLITECHNIKA WARSZAWSKA



**Dziękuję za zaproszenie!**

dr hab. inż. Bartłomiej Ufnalski, prof. uczelni  
Politechnika Warszawska  
Wydział Elektryczny  
Instytut Sterowania i Elektroniki Przemysłowej  
Zakład Napędu Elektrycznego



<https://www.mathworks.com/matlabcentral/profile/authors/2128309-bartlomiej-ufnalski>  
<https://www.youtube.com/channel/UCLED0zzPdsxxwWTQ51eL93A>



bartlomiej.ufnalski @ ee.pw.edu.pl



[www.pw.edu.pl](http://www.pw.edu.pl)  
[www.ee.pw.edu.pl](http://www.ee.pw.edu.pl)  
[www.isep.pw.edu.pl](http://www.isep.pw.edu.pl)  
[www.isep.pw.edu.pl/zne](http://www.isep.pw.edu.pl/zne)



Kampus główny Politechniki Warszawskiej  
Gmach Elektrotechniki, pok. 401, kl. B  
<https://goo.gl/maps/D5Pmy6auMcw>



+48 22 234 6138



## Looking for a gift for your parents or teachers?

**Make It Stick** by Peter C. Brown et al., 2014  
The Science of Successful Learning

**Creative Schools** by Ken Robinson and Lou Aronica, 2016  
Revolutionizing Education from the Ground Up

**You, Your Child and School** by Ken Robinson and Lou Aronica, 2018  
Navigate Your Way to the Best Education

**The PBL Playbook** by A. J. Juliani, 2018  
A Step-by-Step Guide to Actually Doing Project-Based Learning

**Robot-Proof** by Joseph E. Aoun, 2017  
Higher Education in the Age of Artificial Intelligence

**I Love Learning; I Hate School** by Susan D. Blum, 2017  
An Anthropology of College

**Rewiring Education** by John Couch and Jason Towne, 2018  
How Technology Can Unlock Every Student's Potential

**The Intelligence Trap** by David Robson, 2019  
Why smart people do stupid things and how to make wiser decisions





## Looking for a gift for your parents or teachers? (cont.)

**Why?** by Mario Livio, 2017

What Makes Us Curious

**The Road Less Stupid** by Keith J. Cunningham, 2018

Advice from the Chairman of the Board

**The Creativity Code** by Marcus du Sautoy, 2019

How AI Is Learning to Write, Paint and Think

**The Four Horsemen** by Richard Dawkins et al., 2019

The Discussion That Sparked an Atheist Revolution

**Count Girls In** by Karen Panetta and Katianne Williams, 2018

Empowering Girls to Combine Any Interests with STEM to Open Up a World of Opportunity

**The Class** by Heather Won Tesoriero, 2018

A Life-Changing Teacher, His World-Changing Kids, and the Most Inventive Classroom in America

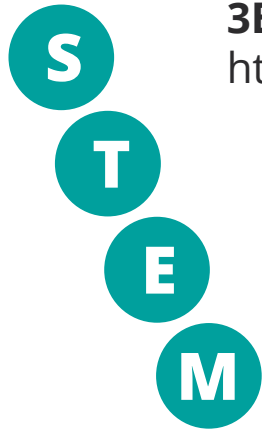
**Team Human** by Douglas Rushkoff, 2019

**Creating and Capturing Value Through Crowdsourcing** by Christopher L. Tucci (editor) et al., 2018





# STEM (Science, Technology, Engineering, Mathematics) is fun!



**3Blue1Brown**

[https://www.youtube.com/channel/UCYO\\_jab\\_esuFRV4b17AjTaw](https://www.youtube.com/channel/UCYO_jab_esuFRV4b17AjTaw)

**minutephysics**

<https://www.youtube.com/channel/UCUHW94eEFW7hkUMVaZz4eDg>

**Real Engineering**

[https://www.youtube.com/channel/UCR1luLEqb6UEA\\_zQ81kwXfg/featured](https://www.youtube.com/channel/UCR1luLEqb6UEA_zQ81kwXfg/featured)

**Mathologer**

[https://www.youtube.com/channel/UC1\\_uAIS3r8Vu6JjXWvastJg](https://www.youtube.com/channel/UC1_uAIS3r8Vu6JjXWvastJg)

**MajorPrep**

[https://www.youtube.com/channel/UCpCSAcbqs-sjEVfk\\_hMfY9w](https://www.youtube.com/channel/UCpCSAcbqs-sjEVfk_hMfY9w)

**Numberphile**

<https://www.youtube.com/channel/UCoxcjg-8xIDTYp3uz647V5A>

**Veritasium**

<https://www.youtube.com/user/1veritasium>

**SmarterEveryDay**

<https://www.youtube.com/user/destinws2>

**Vsauce**

<https://www.youtube.com/user/Vsauce>



Image by rawpixel on Pixabay

# All science is either physics or stamp collecting

Ernest Rutherford

**LHC**



**Smashing Physics** by Jon Butterworth, 2014

Inside the Discovery of the Higgs Boson

<https://www.audible.co.uk/pd/Smashing-Physics-Audiobook/B00LUVOS42>

**LIGO**



**Black Hole Blues and Other Songs from Outer Space** by Janna Levin, 2016

<https://www.audible.co.uk/pd/Black-Hole-Blues-and-Other-Songs-from-Outer-Space-Audiobook/B01D0MQ400>

**BICEP**



**Losing the Nobel Prize** by Brian Keating, 2019

A Story of Cosmology, Ambition, and the Perils of Science's Highest Honor

<https://www.audible.co.uk/pd/Losing-the-Nobel-Prize-Audiobook/1541443985>

**Quantum Physics** by Michael Raymer, 2017

What Everyone Needs to Know

<https://www.audible.co.uk/pd/Quantum-Physics-Audiobook/B07LFJ9XRC>

**For the Love of Physics** by Walter Lewin, 2011

From the End of the Rainbow to the Edge of Time -  
A Journey Through the Wonders of Physics

<https://www.audible.co.uk/pd/For-the-Love-of-Physics-Audiobook/B005ESYH4S>



The first principle is that you must not fool yourself – and you are the easiest person to fool.

Richard Feynman

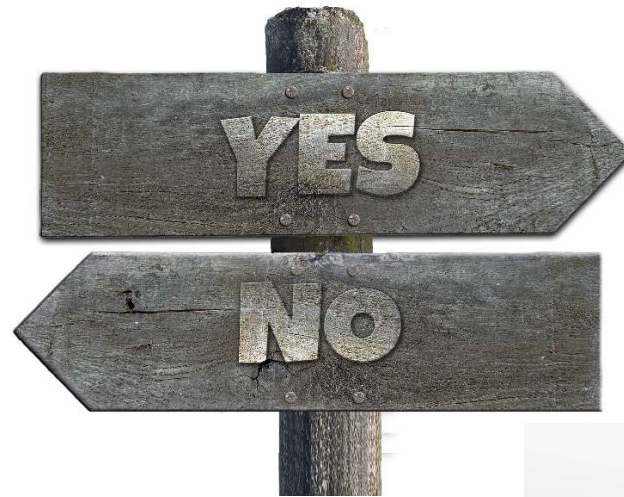


Image by geralt on Pixabay



Image by OpenClipart-Vectors on Pixabay



**Bad Blood** by John Carreyrou, 2018  
Secrets and Lies in a Silicon Valley Startup



**EEVblog:** Solus Graphene Heater Kickstarter BUSTED!  
<https://www.youtube.com/watch?v=JnM4UcSDDpk>



**Cartoonium:** 28314 Years Before Commercials  
<https://www.youtube.com/watch?v=jmHG92IARUQ>

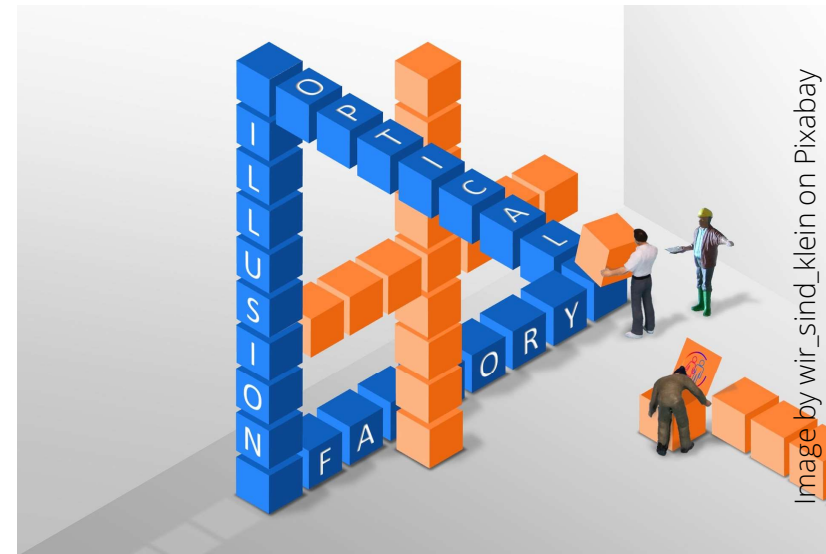


Image by wir\_sind\_klein on Pixabay



Information wants to be free.  
Stewart Brand

MOOC = Massive Open Online Course

Brilliant      Udacity      Stanford Online

MIT OpenCourseWare      edX      Udemy

Skillshare      Coursera      Khan Academy



**Biblioteka  
Główna**

POLITECHNIKA WARSZAWSKA

[http://www.bg.pw.edu.pl/  
#zasoby-elektroniczne](http://www.bg.pw.edu.pl/#zasoby-elektroniczne)

**Revolution in Higher Education** by Richard A. Demillo  
and Andrew J. Young, 2015

How a Small Band of Innovators Will Make College  
Accessible and Affordable

[https://www.audible.co.uk/pd/Revolution-in-Higher-  
Education-Audiobook/B0147QJ51M](https://www.audible.co.uk/pd/Revolution-in-Higher-Education-Audiobook/B0147QJ51M)

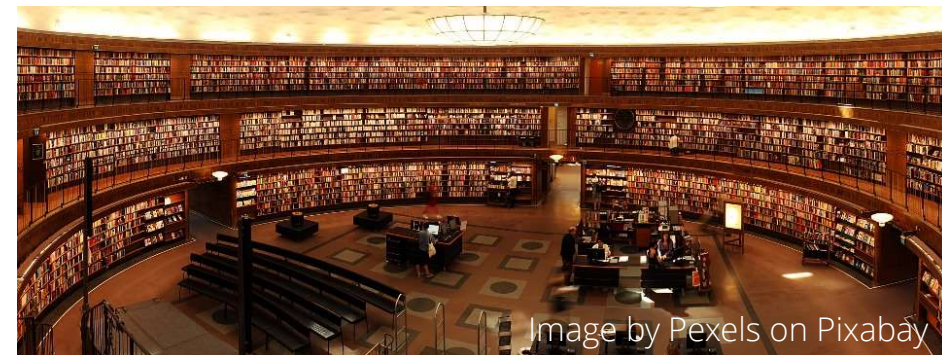


Image by Pexels on Pixabay



# Miscellaneous



**SciFun:** Czy Sztuczna Inteligencja zabierze nam pracę?  
<https://www.youtube.com/watch?v=LSPQPryIAQ>



**To Już Jutro:** Czy elektronika zastąpi kierowców?  
<https://www.youtube.com/watch?v=BUqTvujw-fU>



**EEVblog:** Car ECO OBD2 Fuel Saver SCAM!  
<https://www.youtube.com/watch?v=XgXwfBTKLGU>



**Tim Minchin:** 9 Life Lessons  
<https://www.youtube.com/watch?v=yoEezZD71sc>



**Simon Sinek:** 5 Rules to Follow as You Find Your Spark  
<https://www.youtube.com/watch?v=8l-YpiiBH4o>



**Simon Sinek:** How to Get People to Follow You  
<https://www.youtube.com/watch?v=IPwYUDD9Pd4>



**Simon Sinek:** The Infinite Game  
<https://www.youtube.com/watch?v=tye525dkfi8>

## Miscellaneous (cont.)



**SmarterEveryDay:** Circular Saw Kickback Killer  
<https://www.youtube.com/watch?v=OdW7vhYYsDM>



**NASA Valkyrie Robot:** Valkyrie Scaffolding Demo  
<https://www.youtube.com/watch?v=ARvBAwB0g10>



**FightMediocrity:** WHY I QUIT YOUTUBE  
<https://www.youtube.com/watch?v=li-EwaPfAC0>



**FightMediocrity:** Why I Stopped Reading Self-Help and Self-Improvement Books  
<https://www.youtube.com/watch?v=XgXwfBTKLGU>



**Grammarly:** Are You Ready to Try Grammarly?  
<https://www.youtube.com/watch?v=3YIpF1hlwm8>



**DeepMind:** Game highlights of AlphaStar versus Team Liquid's TLO and MaNa  
<https://www.youtube.com/watch?v=6EQAsrfUlyo>



**Wintergatan:** Marble Machine (muzyk czy inżynier?)  
<https://www.youtube.com/user/wintergatan2000>

## Miscellaneous (cont.)



**UczelniaASBIRO**

<https://www.youtube.com/user/UczelniaASBIRO>



**Miłosz Brzeziński**

<https://www.youtube.com/watch?v=4sf18oNBQ7M>



**PhD Comics**

<http://phdcomics.com/>



**xkcd**

<https://xkcd.com/>



**Dollar auction**

[https://en.wikipedia.org/wiki/Dollar\\_auction](https://en.wikipedia.org/wiki/Dollar_auction)



**Maurice Conti:** The incredible inventions of intuitive AI

[https://www.ted.com/talks/maurice\\_conti\\_the\\_incredible\\_inventions\\_of\\_intuitive\\_ai](https://www.ted.com/talks/maurice_conti_the_incredible_inventions_of_intuitive_ai)



**Education works best when all the parts are working**

[https://www.reddit.com/r/facepalm/comments/2hxzda/education\\_works\\_best\\_when\\_all\\_the\\_parts\\_are/](https://www.reddit.com/r/facepalm/comments/2hxzda/education_works_best_when_all_the_parts_are/)



## Miscellaneous (cont.)



**ColdFusion:** Deepfakes - Real Consequences  
<https://www.youtube.com/watch?v=dMF2i3A9Lzw>



**ColdFusion :** Boston Dynamics New Robot - Will it Take our Jobs?  
<https://www.youtube.com/watch?v=nvz3ODBtFlo>



**See Bloggers:** Jak nie być debilem i nie rozprzestrzeniać głupot w sieci  
<https://www.youtube.com/watch?v=KKjd9S3RY24>



**Uniwersytet SWPS:** Pseudorecepty charyzmatycznych mówców motywacyjnych  
[https://www.youtube.com/watch?v=miC90F\\_D-DQ](https://www.youtube.com/watch?v=miC90F_D-DQ)



**Neil deGrasse Tyson:** Lecture at the University of Washington, 2011  
<https://www.youtube.com/watch?v=wp6cnp1kZBY>



**fullychargedshow**  
<https://www.youtube.com/user/fullychargedshow>



**EEVblog:** Digital Energy Savers BUSTED!  
<https://www.youtube.com/watch?v=yw6mf2sWk2k>

## Miscellaneous (cont.)



**MajorPrep:** The Most Misleading Patterns in Mathematics  
<https://www.youtube.com/watch?v=kp1C0E8Za7k>



**Jalopnik**  
<https://www.youtube.com/watch?v=pgu6mkKZwNg>



**Robohub**  
<https://robohub.org/>



**Bartłomiej Ufnalski:** LEGO Mindstorms EV3 BallBot using MATLAB Simulink  
<https://www.youtube.com/watch?v=1UPRloKwicM>



**Marketoonist**  
<https://marketoonist.com/>



**Sheperd Doeleman:** Inside the black hole image that made history, 2019  
[https://www.ted.com/talks/  
sheperd\\_doeleman\\_inside\\_the\\_black\\_hole\\_image\\_that\\_made\\_history](https://www.ted.com/talks/sheperd_doeleman_inside_the_black_hole_image_that_made_history)



**Projekt edukacyjny STEM PW**  
<https://stem.pw.edu.pl/>

# Exemplary programs/models/codes



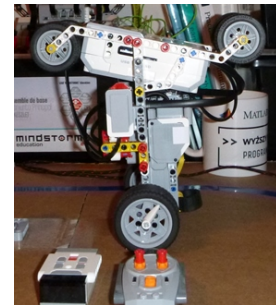
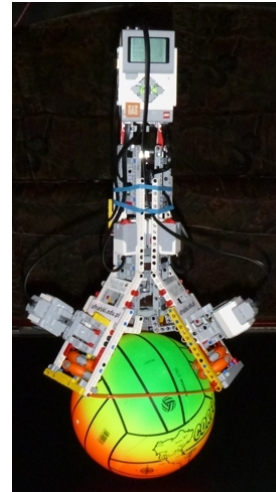
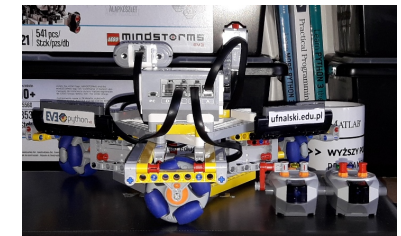
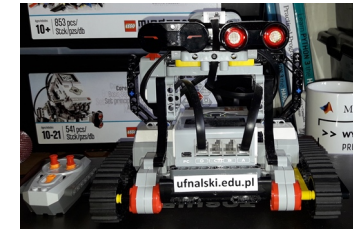
**LEGO Mindstorms EV3 Gyro Boy using Simulink**  
<https://www.mathworks.com/matlabcentral/fileexchange/71279-lego-mindstorms-ev3-gyroboy-using-simulink>



**LEGO Mindstorms EV3 Line Follower using Simulink**  
<https://www.mathworks.com/matlabcentral/fileexchange/71382-lego-mindstorms-ev3-line-follower-using-simulink>



**LEGO Mindstorms EV3 BallBot using Simulink**  
<https://www.mathworks.com/matlabcentral/fileexchange/71544-lego-mindstorms-ev3-ballbot-using-simulink>



**LEGO Mindstorms EV3 DogoSorter using pybricks Python library**  
[http://ufnalski.edu.pl/python\\_projects/lego\\_ev3/ev3\\_dogosorter.zip](http://ufnalski.edu.pl/python_projects/lego_ev3/ev3_dogosorter.zip)



**LEGO Mindstorms EV3 TankBot using ev3dev2 Python library**  
[http://ufnalski.edu.pl/python\\_projects/lego\\_ev3/ev3\\_tankbot.zip](http://ufnalski.edu.pl/python_projects/lego_ev3/ev3_tankbot.zip)



**LEGO Mindstorms EV3 OmniBot using ev3dev2 Python library**  
[http://ufnalski.edu.pl/python\\_projects/lego\\_ev3/ev3\\_omnibot.zip](http://ufnalski.edu.pl/python_projects/lego_ev3/ev3_omnibot.zip)



**More on the way! Stay tuned!**

<https://www.youtube.com/channel/UCLED0zzPdsxxwWTQ51eL93A>



# Awesome third-party stuff for your LEGO EV3 projects

**Mindsensors**

<http://www.mindsensors.com/>



**Rotacaster**

<https://www.rotacaster.com.au/>

**Robotistan**

<https://www.robotistan.com/>

**RobotShop**

<https://www.robotshop.com/>

Tu już byłem w 2019 ☺



## Zespół Szkół Licealnych i Technicznych nr 1

Warszawa, ul. Wiśniowa 56

Technikum Mechatroniczne nr 1

LXXX Liceum Ogólnokształcące im. Leopolda Staffa

