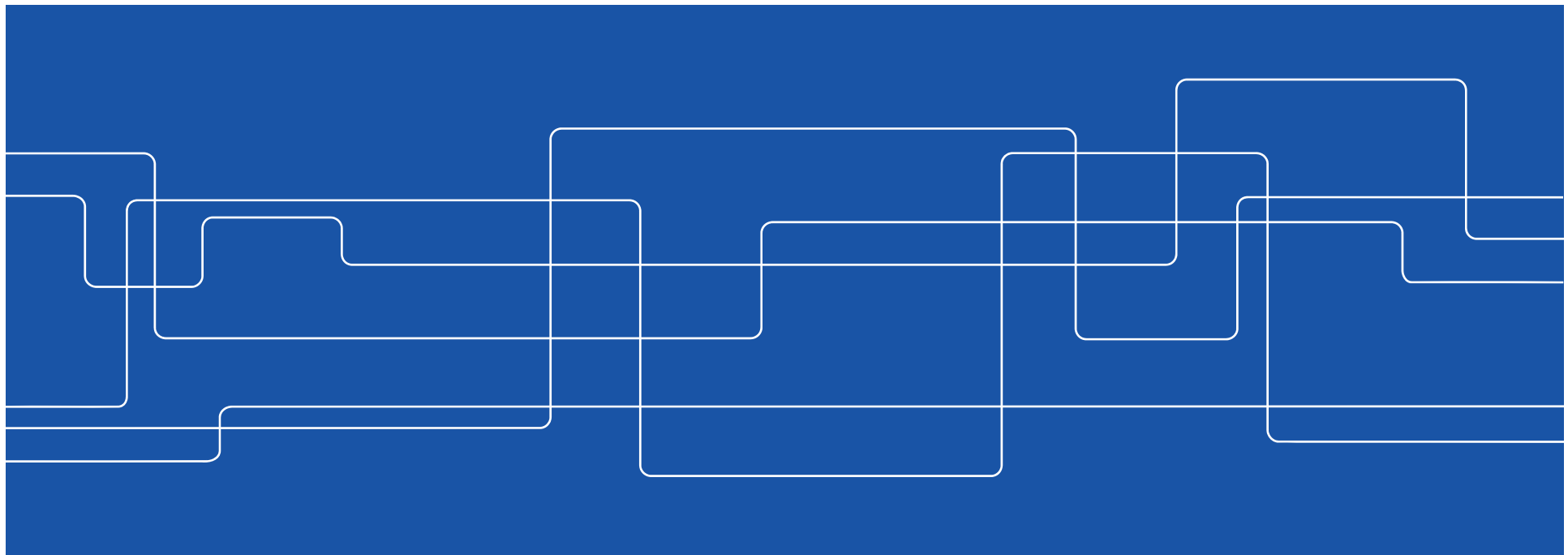# Mechatronics Education at KTH
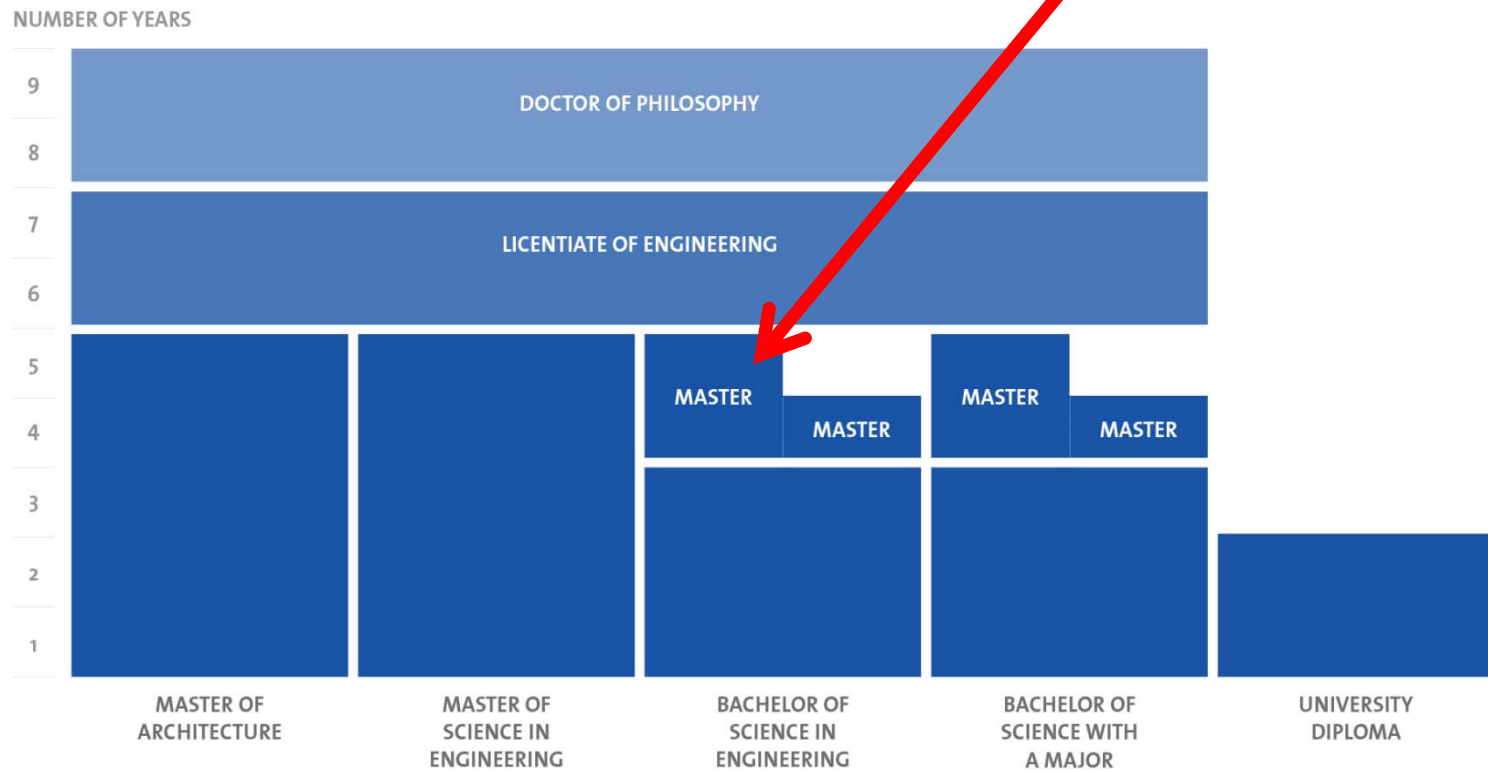
(and Embedded Systems)

Martin Edin Grimheden
KTH Royal Institute of Technology

Structure of education

Mechatronics track

The Mechatronics program

Year 1 (60 hp credits)				Year 2 (60 hp credits)			
Fall		Spring		Fall		Spring	
P1	P2	P3	P4	P1	P2	P3	P4
MF2070 Introduction to Engineering Design (3hp)		free electives (6hp)		MF2071 Research Methodology in Mechatronics (4.5hp)		MF204X Master thesis project in Mechatronics (30hp)	
free electives (9hp)	MF2042 Embedded Systems (6hp)	MF2007 Dynamics and Motion Control (9hp)	MF2044 Embedded Systems II (6hp)	free electives (10.5hp)			
				MF2059 Mechatronics Advanced Course part 2 (15hp)			
MF2030 Mechatronics Basic course (6hp)	MF2043 Robust Mechatronics (6hp)	MF2058 Mechatronics Advanced Course part 1 (6hp)					

Educational idea

Production are outsorced outside Sweden, development tend to follow

Sweden has great opportunities for development of complex, knowledge-intensive products

- Requires non-hierarchical structures, high technical competence, creativity, innovation

We train leaders for the development of advanced products

- Who understands the technology, the development and the trends
- Who can create new products

Or

We like to build robots.

Popularity

KTH (Largest technical university in Scandinavia)

       14 combined BSc+MSc programs (5 year degrees)

Mechanical Engineering, one of the largest and programs

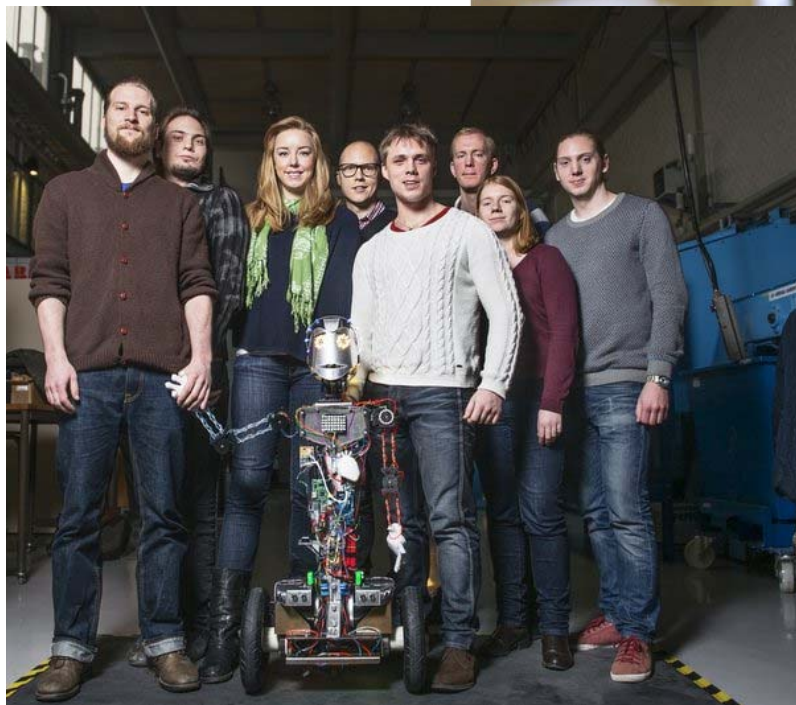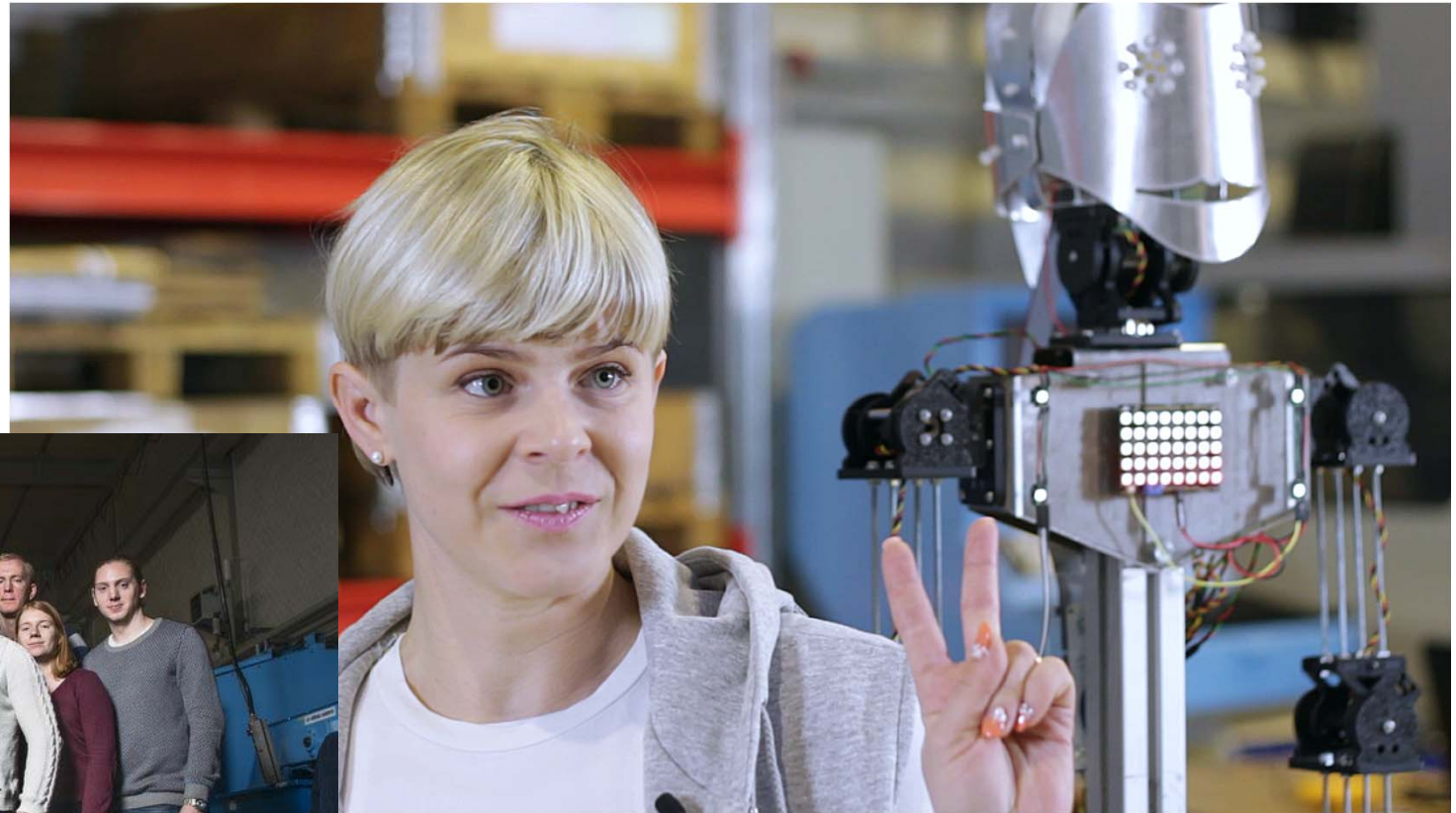   17 "specializations" (=MSc programs)

Mechatronics Track is the most popular of these

The Robyt project – a dancing robot
- as an example of a larger capstone project

www.kth.se/robot

A typical capstone project

Design brief: Develop a product that actively simulates a lung and measures the output from a ventilator

A large company

- Competent and engaged staff
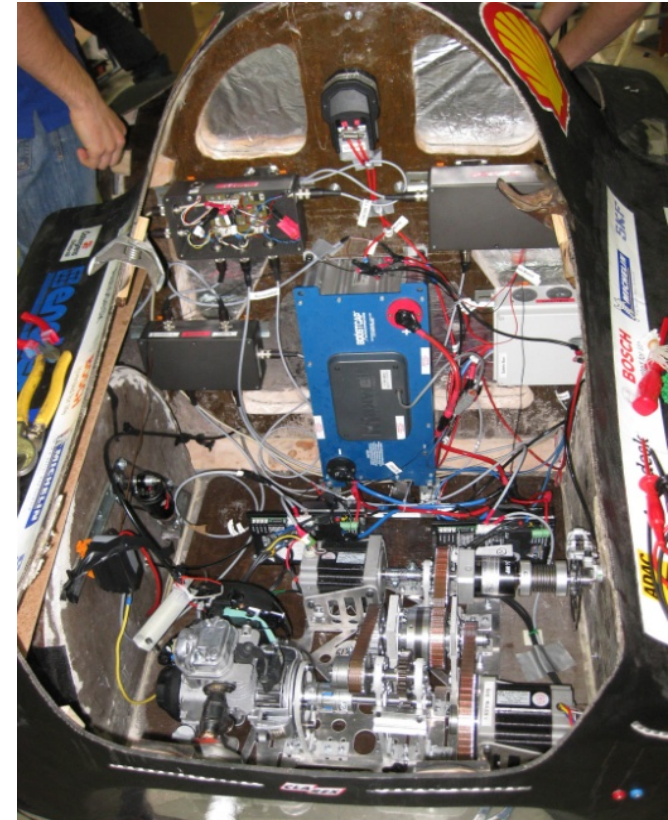
Substantial budget

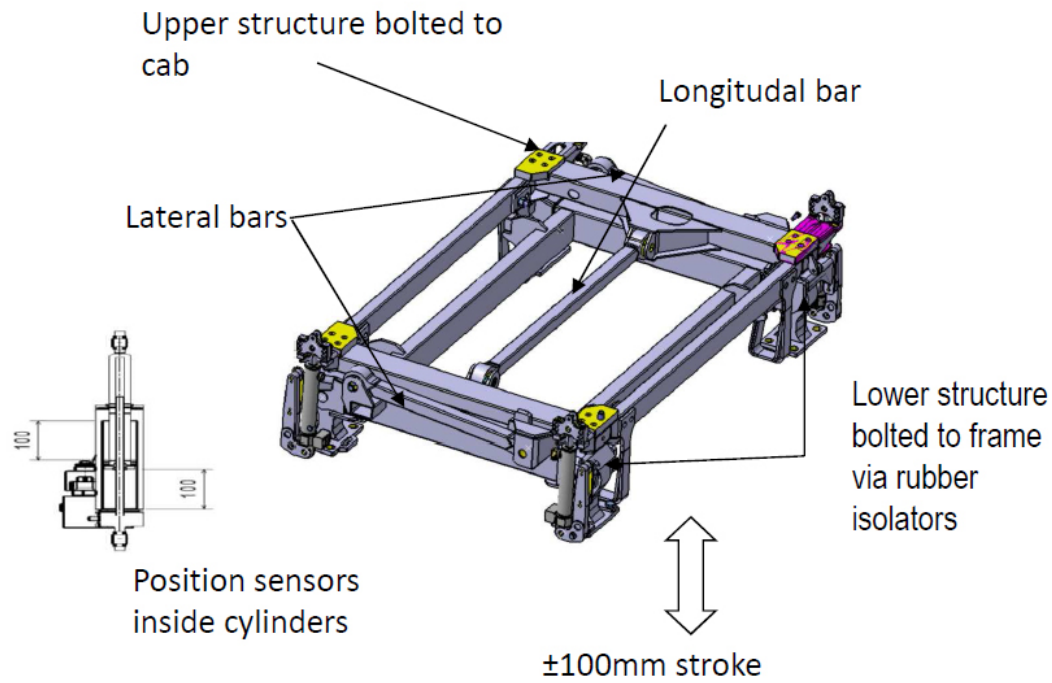- Resources from company

Adaptive knee-prosthesis

KTH Eco Cars

Upper structure bolted to cab

Longitudal bar

Lateral bars

Lower structure bolted to frame via rubber isolators

Position sensors inside cylinders

±100mm stroke

100

100

Active damping control system overveiw

CRIO 9076 Chassi

LX45 FPGA

400 MHz Real-Time Controller

Computer

NI 9853
2-Port, High-Speed CAN Module

NI 9203
8-Ch ±20 mA, 200 kS/s, 16-Bit Analog Current Input Module

Angular measurement

CHR-UM6
IMU Upper Frame

CHR-UM6
IMU Lower Frame

mbed LPC1768
UART <-> CAN

CAN 0

CAN 1

PVX
Hydraulic Valve

Front Left Cylinder

Front Right Cylinder

Rear Left Cylinder

Rear Right Cylinder

Figure 4.18: System overview.

COMFORT RIDE

895

Euler angles, Stewart induced disturbance Roll: 4 deg 0.4 Hz, Pitch: 1.5 deg 0.2 Hz
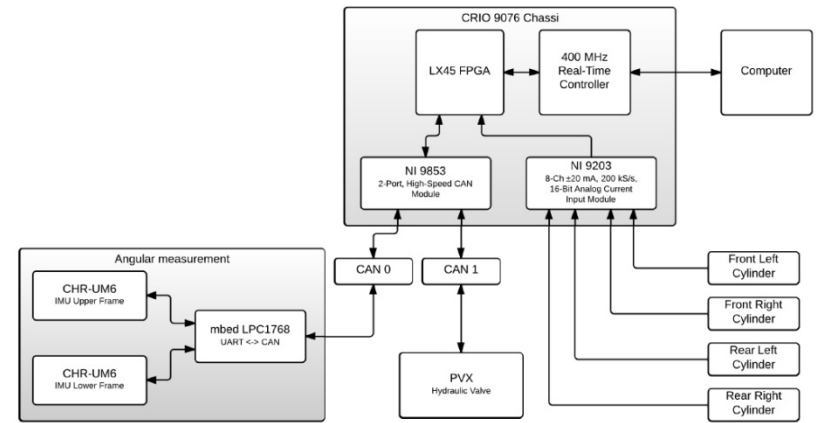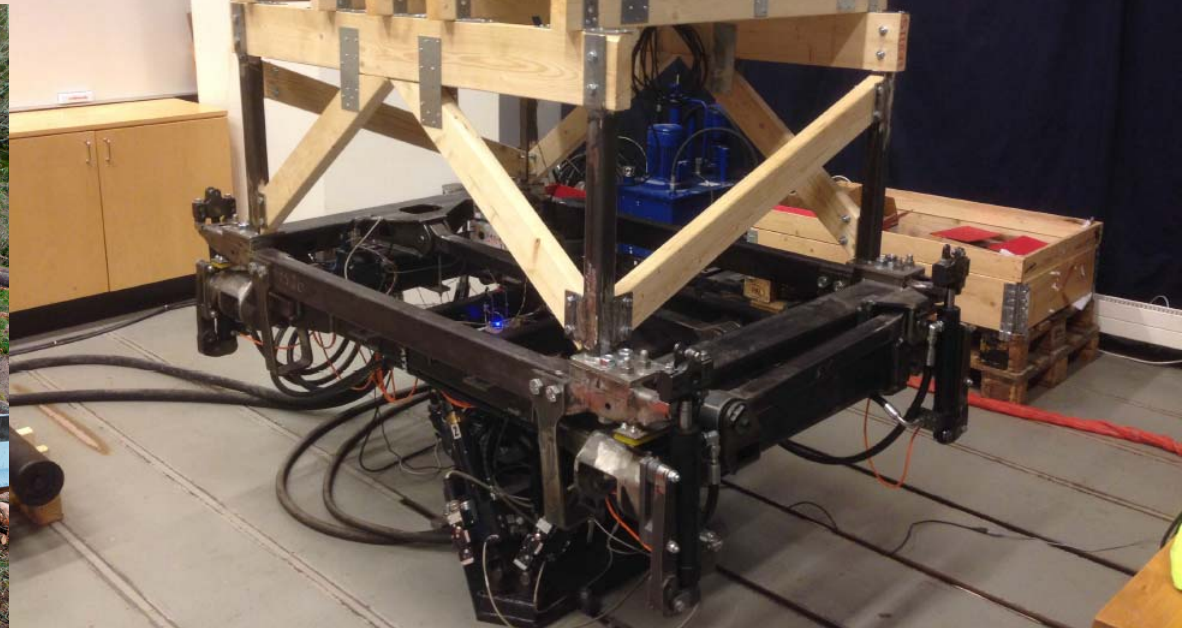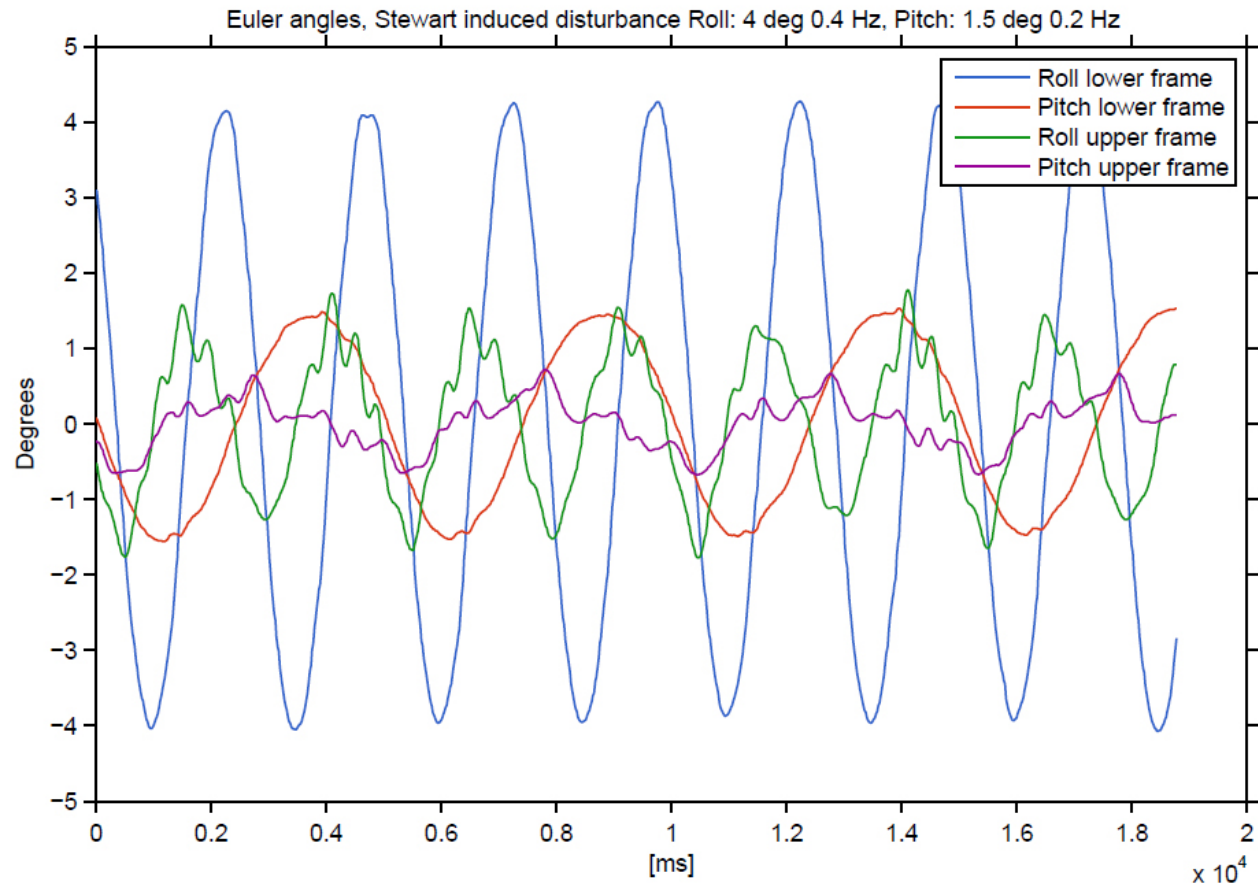
Balances defining the subject

Depth – Breadth

Knowledge – Skills

Academic – Industrial

Theory – Practice

General - Specific

Legitimacy

Formal ←————————————————————————————→ Functional

Requirements from the society/industry/…
For example, how the requirements are specified

Identity

Disciplinary ←————————————————→ Thematic

Characteristics of the subject, is it a discipline or a theme? What's the difference?
Hint: multidisciplinary areas, like mechatronics, typically starts as themes, such as robotics

Selection

Representation ←—————————————————→ Exemplification

What do we teach? Breadth or depth, a little of everything or everything of something
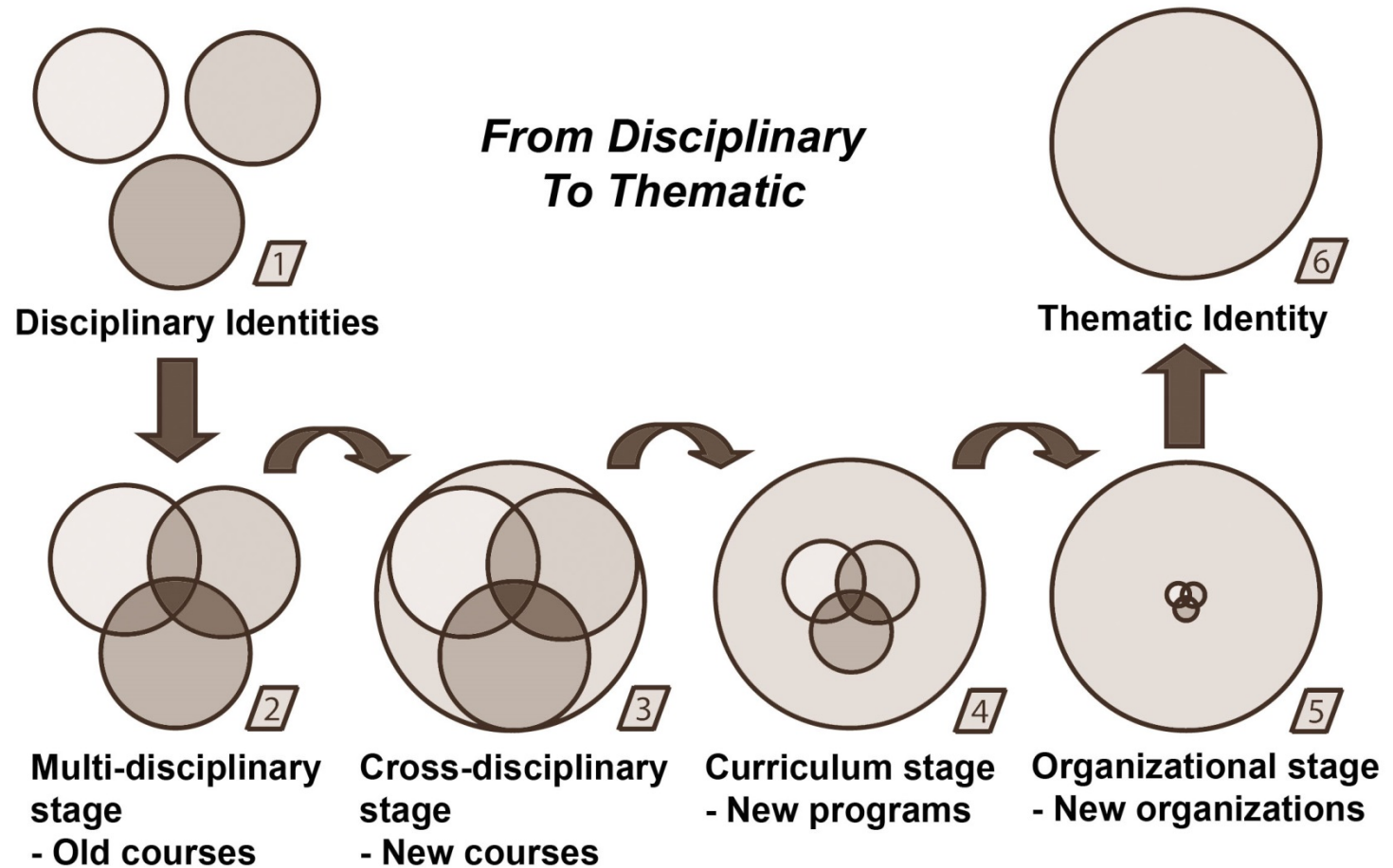
Communication

Active ←————————————————————————→ Interactive

How do we communicate/teach? Open-loop or closed-loop?
Interactive also means that the selection of the subject is dependent on
previous knowledge, skills

The Evolution of Mechatronics as an Academic Discipline

From Disciplinary To Thematic

Disciplinary Identities [1]

Thematic Identity [6]

Multi-disciplinary stage
- Old courses [2]

Cross-disciplinary stage
- New courses [3]

Curriculum stage
- New programs [4]

Organizational stage
- New organizations [5]

Thank you

mjg@kth.se