

20 juni 2017  
1931 Congrescentrum Den Bosch

**POWER  
ELECTRONICS** 2017

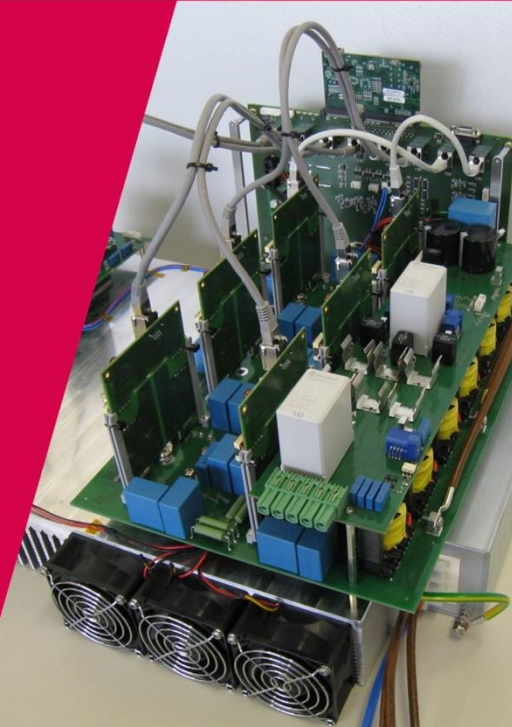
electromechanics  
power/electronics  
**e pe**

# Hoe kan de wetenschap de praktijk een power boost geven?

How can Science power boost Practice?

**Korneel Wijnands**

*June 20<sup>th</sup> 2017*



**TU/e**

Technische Universiteit  
**Eindhoven**  
University of Technology

**Where innovation starts**

# Personal introduction

Fellow of the University in the Electromechanics and Power electronics group of the TU/e

Technology lead power electronics at Prodrive Technologies



Linear PE ~1982

# Dutch 4TU landscape

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UNIVERSITY  
OF TWENTE.



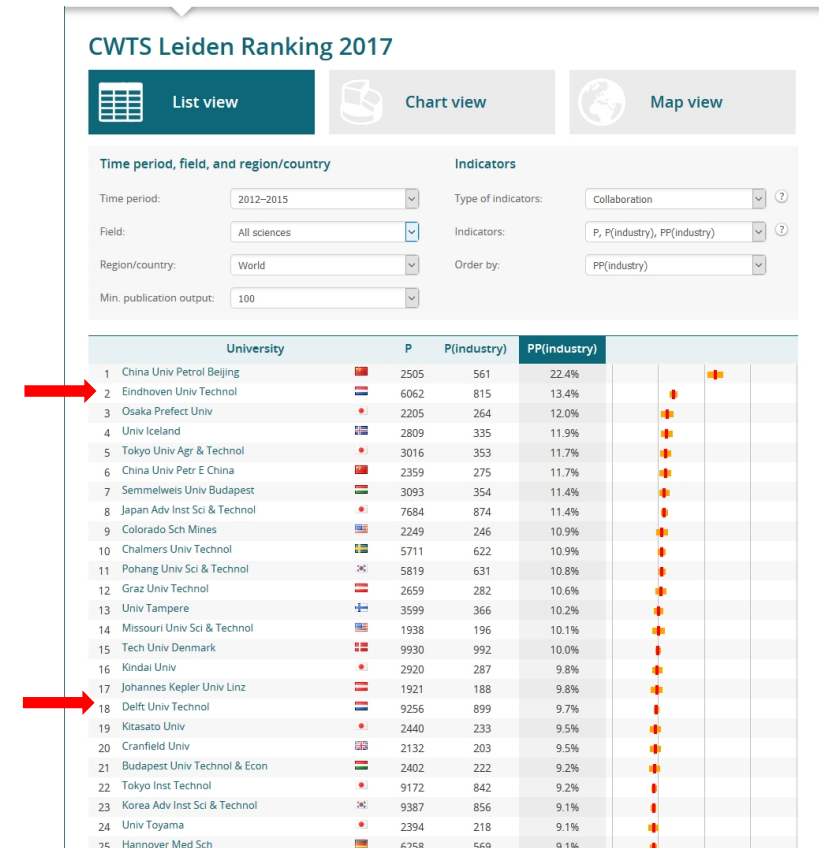
# Cooperation of TU with industry

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'TU/e blijft wereld top qua samenwerking met industrie

De TU Eindhoven is wereldwijd de universiteit met de op één na sterkste onderzoekssamenwerking met de industrie. Dat blijkt uit de CWTS Leiden Ranking die gisteren verschenen is'

(bron: Website TU/e, 18 mei 2017)



2<sup>nd</sup>/18<sup>th</sup> place for publications with industry

# PE cooperation with TU

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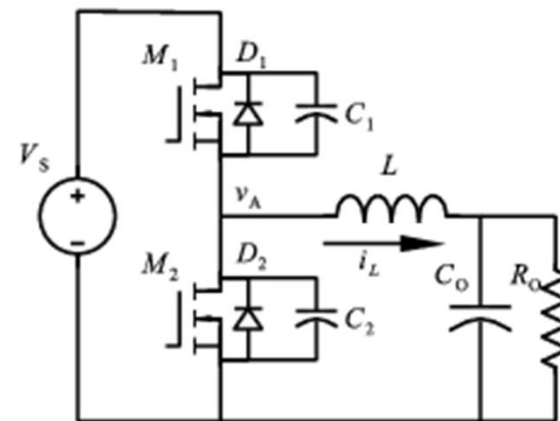
Who has cooperated with a TU last 2 years?



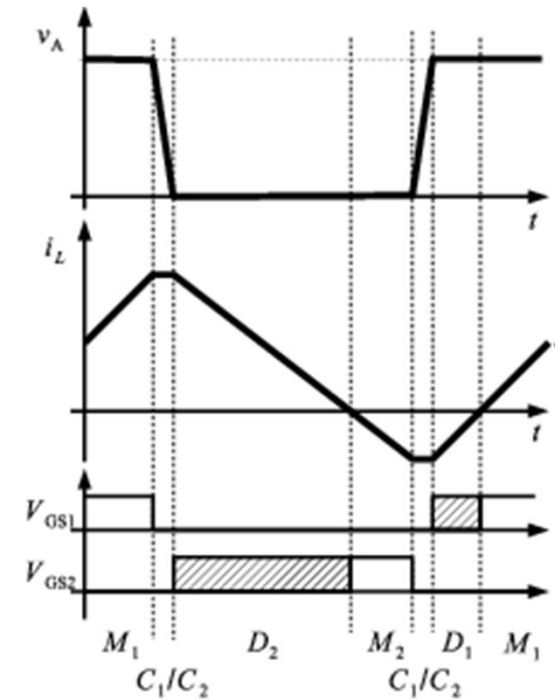
UNIVERSITY  
OF TWENTE.



Positive experience?



(a)

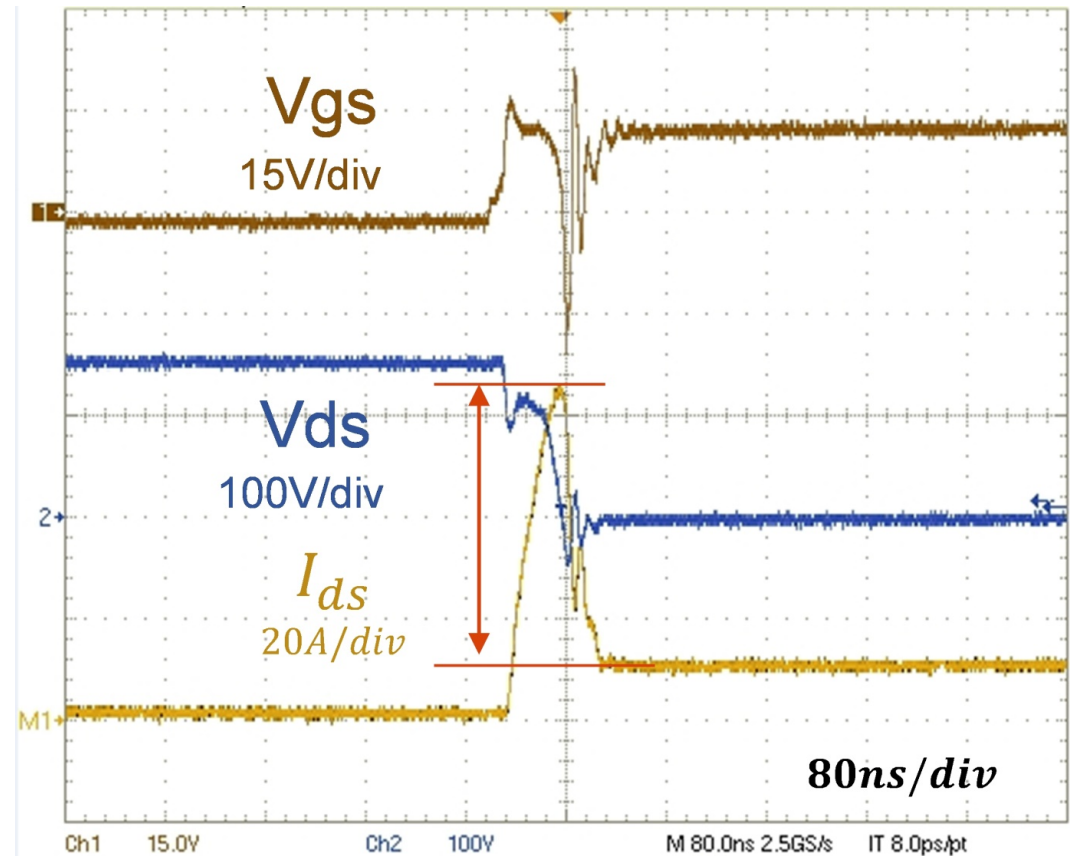


(b)

Soft-switching half bridge

# PE cooperation with TU

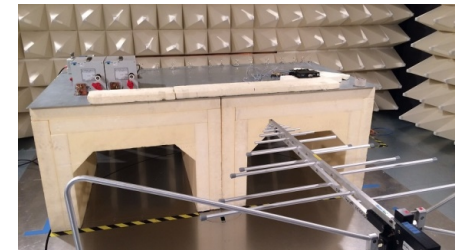
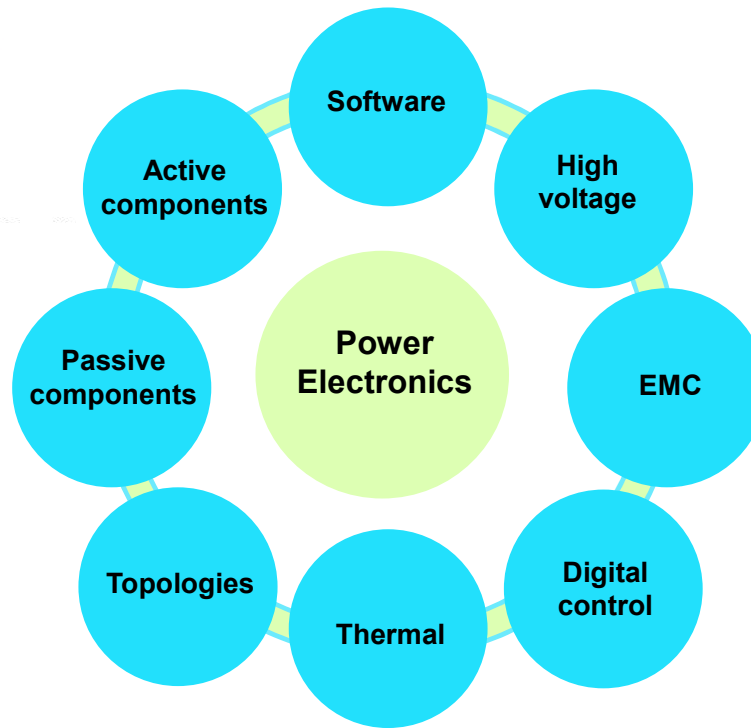
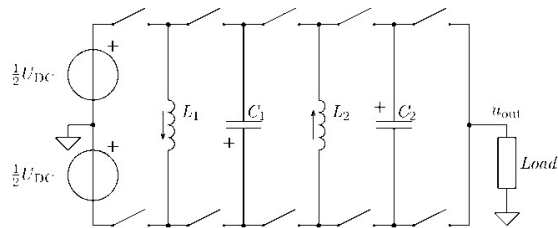
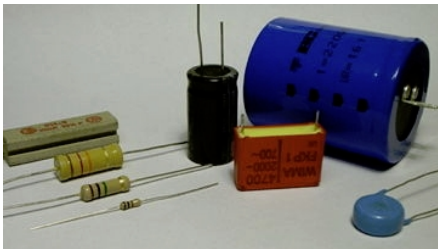
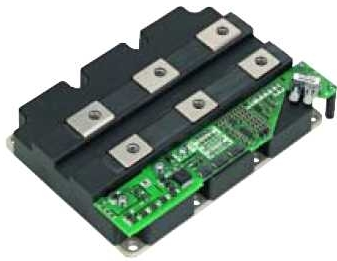
Negative experience ?



Hard-switching half bridge



# Which faculty or group to approach?

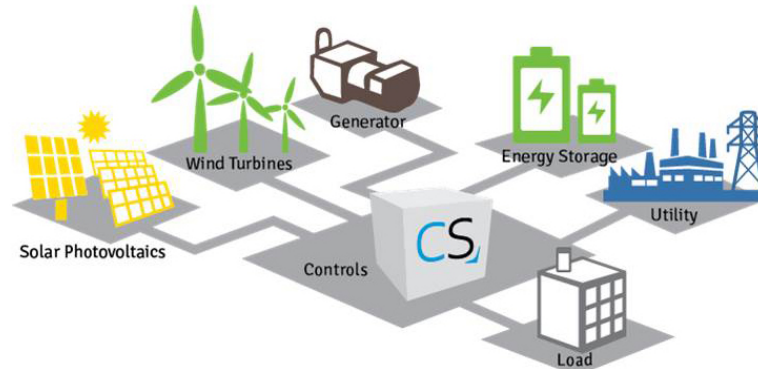




# Focus of TU/e Electromechanics and Power electronics group

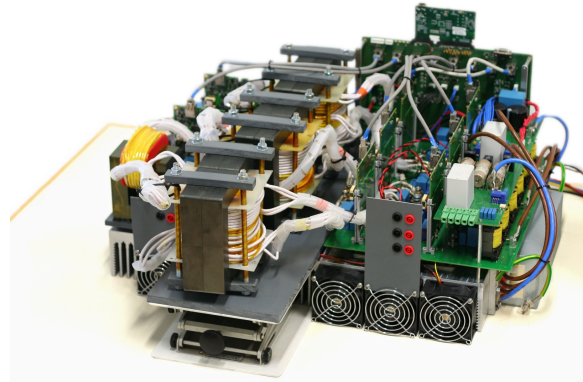
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System



Energy management,  
system control

Components



Multi physical phenomena,  
local control

Devices



Materials, physical  
phenomena

# PE research focus of TU/e EPE group

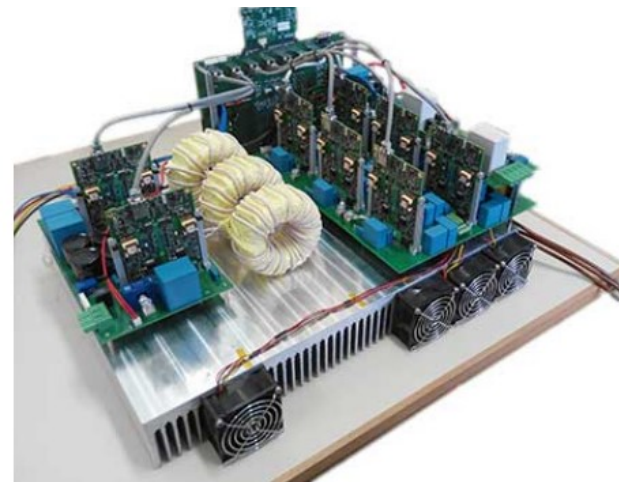
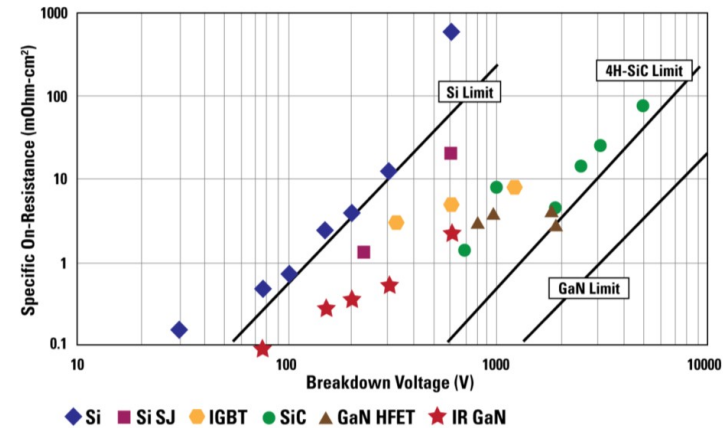
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Replace Cu and Fe by more Si and smart control

Increased frequency with SiC/GaN switches

PE topologies for high accuracy and performance

'High' voltage amplifiers



20kW SiC Quad Active bridge converter

# Who can you find at TU/e EPE?

**Elena Lomonova**  
EPE Chair



**Vacancy**  
Advanced magnetic materials  
and computational EM

**Helm Jansen**  
High precision  
actuators



**Henk Huisman**  
Electrical drives



**Jorge Duarte**  
Grid connected  
power converters



**Johan Paulides**  
Electrical components for  
more electrical society



**Marko Merdzan**  
High speed machines



**Maurice Roes**  
Digital control of  
power converters



**Bas Vermulst**  
High precision  
power amplifiers



# Which industrial fellows did already find the TU/e EPE group?

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Konstantin Boynov

Joost Brilman

Jeroen van Duivenbode

Jordi Everts

Bart Gysen

Marcel Hendrix

Lex Molenaar

Timo Overboom

Jan Schellekens

Korneel Wijnands

Steven Wilkins

Protonic

Heliox

ASML

Prodrive Technologies

Prodrive Technologies

Philips Innovation Services

RR Mechatronix

Smit Transformatoren

AME

Prodrive Technologies

TNO Automotive

# Can a TU help,

if I need product development?

No, find a trustworthy company.



Gradient amplifier (Source: Prodrive Technologies)

# Can a TU help,

if my PE product does not work?

No, find a good consultant.



Battery test (Source: Samsung)



# Can a TU help,

if I have no NPO<sub>3</sub> reception?

No, go talk with Lex.

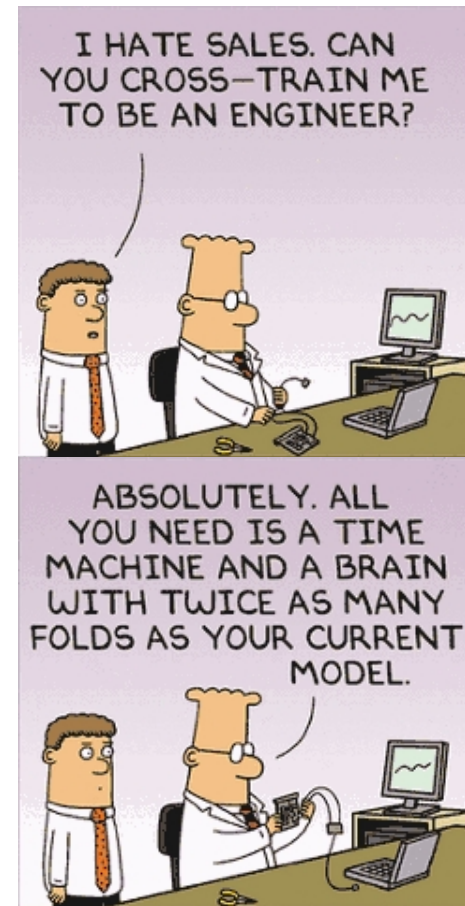


Power line noise (Source: W4NEQ)

# Can a TU help,

if I need cheap engineers?

No, maybe Google can help?



Source: Dilbert.com

## Can a TU help,

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if I need to select a SiC switch?

No, find a decent supplier.



150mm SiC fab at NY-PEMC (SemiconductorToday)

## So, how can a TU help me?

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Find common interest for cooperation

Differentiate in horizon:

- Short term
- Mid term
- Long term



# SHORT term cooperation with TU/e - EPE

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How:

- Internships (3 months)
- Graduation projects (9 months)
- Co-coaching
- Student fee by company

What:

- Technology predevelopment
- Proof of concepts
- 'State of art' technology





# SHORT term cooperation with TU/e – EPE example

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**Bidirectional automotive resonant converter 800V/12V/4kW**

**Research team**

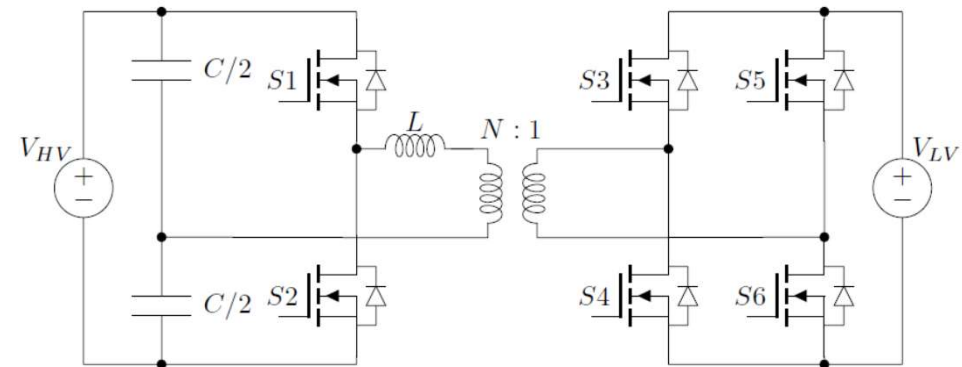
Topology: MSc graduation

Control: MSc graduation

FPGA/DSP: BSc graduation (HTS)

Housing/cooling: BSc internship

Prototype realisation: Prodrive T.



Proof of concept



# SHORT term cooperation with TU/e – Support student initiatives

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WALDUR 'begunstigersdag' Garzweiler



Solar team and Robocup

# MID term cooperation with TU/e - EPE

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How:

- PDeng (2 years)
- Post Doc (2 years)
- Contribution of companies

What:

- Advanced design exercise
- Beyond 'state of art'



# LONG term cooperation with TU/e - EPE

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How:

- PhD (4 years)
- Industrial fellows (part time)
- National or international subsidies
- Contribution of companies

What:

- Research and development



# Possible funding and subsidies

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## National funding examples :

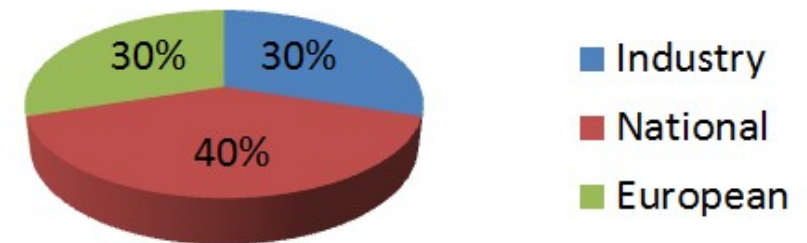
- NWO TTW HTSM,
  - Resources and project execution at TU/e
  - 30% in-kind/in-cash contribution from industrial partners
- RVO urban energy,
  - Funding for industry → 20-55%

## European funding examples:

- ECSEL,
  - Funding for industry → 20-56%
- Marie Skłodowska-Curie Actions,  
2 options to collaborate:
  1. Beneficiary (=full partner): Funding for industry → salary, training and traveling for PhD
  2. Partner: No funding for industry but involved via 2-3 months placement at company

## Direct funding by industry

Types of Funding





# LONG term cooperation with TU/e, national example

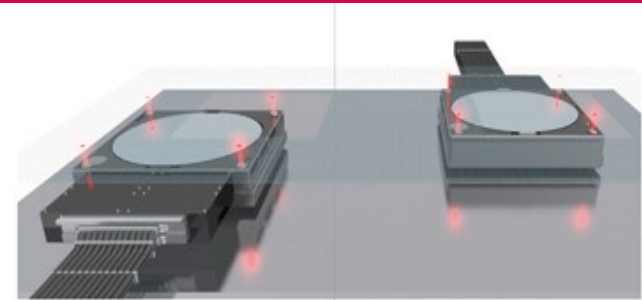
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High Voltage Actuation Systems

2kV motion and connectivity in air  
and vacuum

EPE (2 PhDs)

Electrical Energy Systems (1PhD)



HVAS triple focus

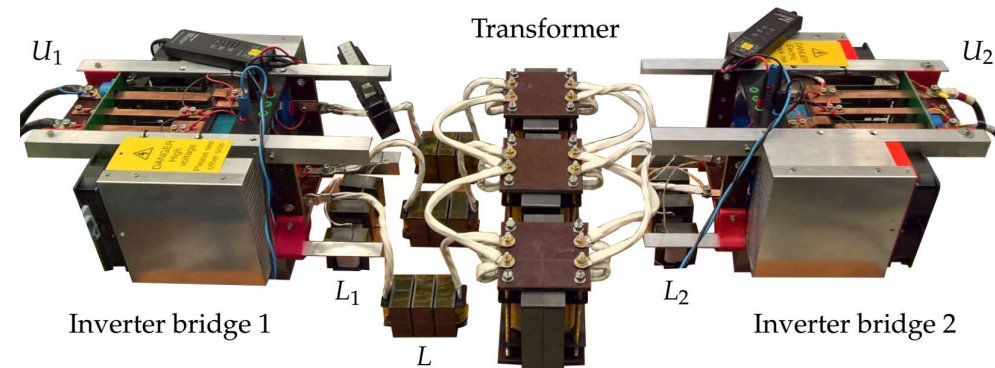
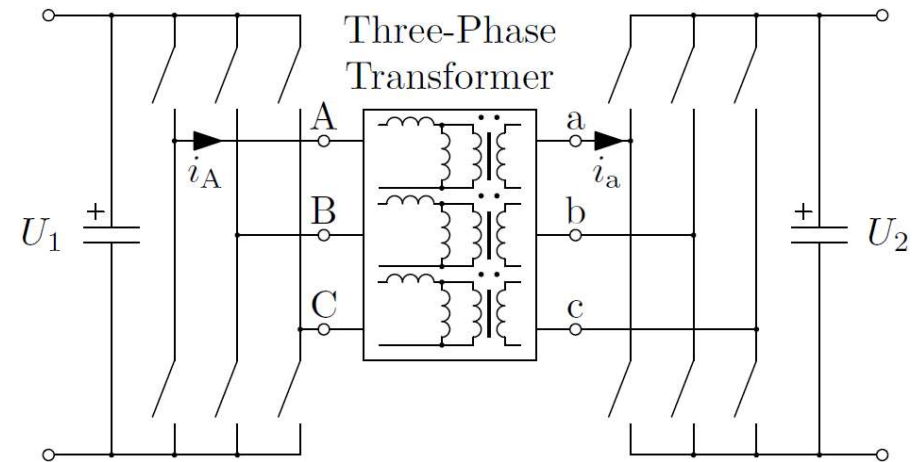


## Advanced reluctance motors for electric vehicle applications

Switched reluctance power train and battery booster

EPE group (2 PhDs)

TU of Cluj Napoca (1 PhD)



100kW 3-level 3-phase SiC Dual Active Bridge





# How can Science power boost Practice?

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Come and discuss your **challenges!**

Find the right **match** to do short, mid and long term R&D.

Team-up with Universities for funding and subsidies.

We try to educate your future success factors!



Knight rider turbo boost...

# Questions

