VRIJE
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Thesis submitted in fulfilment of the requirements for the award of the degree of Doctor of ... (Doctor in de ...)

TITLE OF PHD

Your Name

May 7, 2024

Promotor:	Prof. Dr. ir. ?
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	Random dude (university somewhere)

Faculty of ...
Department of ...

Acknowledgement

I would like to thank ...

Your Name

Abstract

Give here a short summary of your work

List of abbreviations

Below, the list of abbreviations that has been used throughout this thesis, can be found. This list is made per chapter to show where each abbreviation appears first. No new entry will be made if a certain abbreviation returns in a later chapter.

Chapter 1

SPECTA	Series Parallel Constant Torque Elastic Actuation
SEA	Series Elastic Actuation
PEA	Parallel Elastic Actuation
VSA	Variable Stiffness Actuation
SPEA	Series Parallel Elastic Actuation
+SPEA	Series Parallel Elastic Actuation with multiple parallel branches
iSPEA	intermittent Series Parallel Elastic Actuation
DMA	Dual Motor Actuation
DOF	Degrees Of Freedom
SMES	Superconducting Magnetic Energy Storage
CAES	Compressed Air Energy Storage
pHRI	Physical Human-Robot Interaction
NBM	Non Backdrivable Mechanism
CT	Constant Torque

Chapter 2

CTM	Constant Torque Mechanism
ZTS	Zero Torque Shift
CFM	Constant Force Mechanism

Chapter 4

HRI	Human-Robot Interaction

Chapter 5

BLDC	Brushless Direct Current
PMSM	Permanent Magnet Synchronous Machine
PMAC	Permanent Magnet Alternating Current
PSGT	Parallel Shaft Gear Train
PGT	Planetary Gear Train
HD	Harmonic Drive
CD	Cycloid Drive
BS	Ball Screw
WG	Wave Generator
FS	Flexspline
CS	Circular Spline
EC	Eccentricity Cam
CD	Cycloid Disc
RR	Ring rollers with ring gear
OD	Output Disc

List of symbols

Below, the list of symbols that has been used throughout this thesis, can be found. This list is made per chapter to easily find the meaning for each symbol.

Standard Symbols

T	Torque
θ	Angle
K	Spring Stiffness
F	Force
m	Mass
V	Volume
J	Mass moment of inertia
I	Area moment of inertia
d	Diameter
L	Length
t	Thickness
σ	Stress
E	Module of elasticity
b	Width
I	Motor Current
R	Armature Resistance

Standard Subscripts

i	Input
o,out	Output
$spring$,spr	Spring
$mech$	Mechanical
min	Minimum
max	Maximum

Chapter 2

Q	
L_0	Initial length
ΔL	Axial compression
θ_L	Left inclination angle
θ_R	Right inclination angle

Chapter 3

A_{spring}	The torque level of a constant torque spring
R_1	
R_2	
r_0	
c	Minimal required distance between the axes of the drums of a constant torque sp

Chapter 4

r_{gap}	Gap radius
k_t	Motor torque constant
n	Number of wires in the cross-section
H	Magnetic field strength
m_m	Motor mass
J_m	Motor inertia
r_a	Armature radius
l_a	Rotor length
r_m	Motor radius
l_m	Motor length
ρ_a	Armature density
N	Reduction ratio
C	Utilization factor of the machine
B_e	Air gap flux density
α	Pole coverage factor
A	Linear current density
w_a	Number of armature windings
T_{stall}	Stall torque
ρ_w	Specific winding resistance
l_w	Total length of the winding
r_w	Winding radius
A_w	Winding cross-section
t_s	Stator thickness
t_r	Rotor thickness
d_m	Motor diameter

Contents

Chapter 1

Introduction

Give here the introduction...

1.1 Research questions

The goal of this dissertation is to ...

This is divided into several separate research questions:

- **Question 1?**
- **Question 2?**
- **Question 3?**
- **Question 4?**
- **Question 5?**

1.2 Outline of the thesis

The doctoral thesis is divided into... (give here overview of the thesis)

Part I

First Part

Chapter 2

First real chapter

2.1 Introduction

Put here the introduction

2.2 Conclusion

Give here the conclusion of the first chapter

Part II

Part two

Chapter 3

Second chapter

Part III

Conclusion

Chapter 4

Conclusion and future work

4.1 General conclusions

4.1.1 Question 1?

4.1.2 Question 2?

4.1.3 Question 3?

4.1.4 Question 4?

4.1.5 Question 5?

4.2 Future work

Appendix A

List of publications

Publications which are submitted for review, or which are not listed in Scopus (such as poster presentations or publications in journals not listed in Scopus), are listed in grey.

Articles in scientific journals with an international referee system

1. ...
2. ...
3. **Last Name, A.,** Co-author, B., ..., & Last author, C. (2019). Name of paper. Name of Journal, edition number.

Review articles in scientific journals with an international referee system

1. ...

Interational conference papers

1. ...
2. ...

International conference and symposium abstracts and/or posters

1. ...
2. ...