

CONTENT

PREFACE.....	7
1. SUPPLYING AND STORING ENERGY SYSTEMS IN ELECTRIC VEHICLES.....	9
1.1. The general structure of an energy supply and storage system in an electric vehicle.....	9
1.2. Supercapacitors as energy supply and storage.....	11
1.2.1. The theory of the double electric layer.....	12
1.2.2. Types of supercapacitors.....	16
1.2.3. Methods for supercapacitors characterization.....	20
1.3. Modelings, simulations and experiments with supercapacitors.....	24
1.3.1. Electrical models for supercapacitors.....	24
1.3.2. The supercapacitor module model and the test bench.....	26
1.3.3. Identifying the parameters of the supercapacitors modules.....	30
1.3.4. Simulations and the model validation.....	32
1.3.5. Comparative study between the two supercapacitors modules used.....	34
References.....	36
2. ENERGY MANAGEMENT IN DIRECT CURRENT MOTOR TRACTION SYSTEM.....	41
2.1. Supply system for direct current motor.....	41
2.1.1. System description.....	41
2.1.2. Direct current electronic converters.....	45
2.1.3. Case study.....	49
2.2. Modeling of supply system with batteries and supercapacitors used in traction with PMDC motors.....	54
2.2.1. Modeling of batteries module.....	54
2.2.2. Modeling of the system converter - battery - supercapacitor.....	57
2.2.3. Modeling and simulation of PMDC traction motor.....	58
2.2.4. Battery and supercapacitor power supply system modeling.....	61
2.3. Energy management within PMDC traction motor.....	63
2.3.1. General presentation.....	63
2.3.2. Command by passivity.....	64
2.3.3. Implementation of the passivity control in the DC motor system.....	66
2.3.4. System simulation with PBC controller.....	72

2.4. Energy management analysis in PMDC traction motor.....	75
2.5. Stability analysis of linearised PMDC traction motor model.....	76
	78
3. ENERGY MANAGEMENT IN TRACTION SYSTEM WITH SYNCHRONOUS MOTOR.....	82
3.1. Supply System for synchronous motor.....	82
3.1.1. System description.....	82
3.1.2. Test bench for setting energy modules.....	83
3.1.3. Determining the experimental model.....	86
3.2. Synchronous motor simulation under drive cycles.....	92
3.3. Energy management using hybrid supply systems.....	95
3.3.1. Description of the drive cycles adopted.....	96
3.3.2. Simulations with supply system based on batteries.....	97
3.3.3. Experiments with supply system based on batteries.....	101
3.3.4. The control of the supply system based on batteries and supercapacitors	108
3.3.5. Simulations with supply system based on batteries and supercapacitors. . . .	109
3.3.6. Experiments with supply system based on batteries and supercapacitors	113
3.4. Comparative analysis of the energy management using supply systems with batteries and with batteries and supercapacitors.....	121
References.....	131
4. ENERGY MANAGEMENT IN TRACTION SYSTEM WITH INDUCTION MOTOR.....	133
4.1. Configuration of electric vehicle with induction motor.....	133
4.1.1. System description.....	133
4.1.2. Propulsion Induction Motor.....	135
4.1.3. Drive System description.....	141
4.1.4. Battery Device.....	145
4.1.5. Rectifier - Boost converter unit.....	146
4.1.6. Auxiliary loads.....	148
4.1.7. Mechanical transmission.....	148
4.2. Case studies.....	149
4.2.1. Dynamic control of electrical vehicle powered by induction motor.	149
4.2.2. Electronic control system of e-smart vehicle.....	166
References.....	169
Abstract.....	173