

Contents

| | | |
|----------|--|-----------|
| 1 | Introduction | 3 |
| 2 | Fundamental aspects | 7 |
| 2.1 | Magnetic domains and domain walls | 8 |
| 2.1.1 | Magnetic domains | 8 |
| 2.1.2 | Bulk domain walls | 9 |
| 2.1.3 | Geometrically confined domain walls | 12 |
| 2.2 | Anisotropic Magnetoresistance | 15 |
| 2.3 | Magnetization reversal processes | 15 |
| 2.3.1 | Anisotropic magnetoresistance and magnetization reversal | 17 |
| 2.4 | Domain wall magnetoresistance - theoretical models | 19 |
| 2.4.1 | Diffusive regime | 19 |
| 2.4.1.1 | Positive domain wall magnetoresistance | 21 |
| 2.4.1.2 | Negative domain wall magnetoresistance | 24 |
| 2.4.2 | Ballistic regime | 25 |
| 2.5 | Nanocontacts: Experimental situation | 27 |
| 2.5.1 | Large domain wall magnetoresistance - ballistic limit | 27 |
| 2.5.2 | Small domain wall magnetoresistance - diffusive limit | 29 |
| 2.6 | Micromagnetic calculations | 31 |
| 3 | Experimental techniques | 35 |
| 3.1 | Sample preparation | 35 |
| 3.1.1 | Optical lithography | 36 |
| 3.1.2 | Electron beam lithography | 38 |
| 3.2 | Setup for transport measurements | 42 |
| 3.3 | Magnetic Force Microscopy | 44 |
| 4 | Experimental results and discussions | 47 |
| 4.1 | Cobalt thin films | 48 |
| 4.2 | Long rectangular electrodes: Structure A | 51 |
| 4.3 | Mixed electrodes: Structure B | 61 |
| 4.4 | “Butterfly” electrodes: Structure C | 66 |

| | |
|----------------------------------|-----------|
| 5 Conclusions and Outlook | 73 |
| References | 80 |
| Acknowledgments | 88 |
| Curriculum Vitae | 89 |