

Appendix B: Problem specifications

Table A.1: Design specifications for the baseline Flywheel Energy Storage System

Parameter	Value
Housing temperature	30 C
Flywheel axial length	1000 mm
Flywheel diameter	430 mm
Motor axial length	250 mm
Shaft and PM diameter	84 mm
Magnet thickness	6 mm
AMB rated force	5780 N
Max rotational speed	40,000 r/min
Current controller transfer function	$\frac{v(s)}{\epsilon(s)} = G_{ci}(s) = 345 + \frac{2149}{s}$
Position controller transfer function x	$\frac{F_{ocx}(s)}{\epsilon_{ocx}(s)} = k_{px} + \frac{k_{ix}}{s} + \frac{sk_{dx}}{1+s/\omega_{px}}$ $k_{px} = 1.2639 \times 10^8$ $k_{ix} = 1.16868 \times 10^9$ $k_{dx} = 252790$ $\omega_{px} = 3770 \text{ rad/s}$
Tilting position controller transfer function	$\frac{F_{dcx}(s)}{\epsilon_{dcx}(s)} = k_{p\alpha} + \frac{k_{i\alpha}}{s} + \frac{sk_{d\alpha}}{1+s/\omega_{p\alpha}}$ $k_{p\alpha} = 7.6992 \times 10^7$ $k_{i\alpha} = 1.18953 \times 10^9$ $k_{d\alpha} = 80294$ $\omega_{p\alpha} = 6283 \text{ rad/s}$