Motor rotor,

Gear box,

Spring and load:

'm

'g

'g

damp

's

's

app

m

g

s

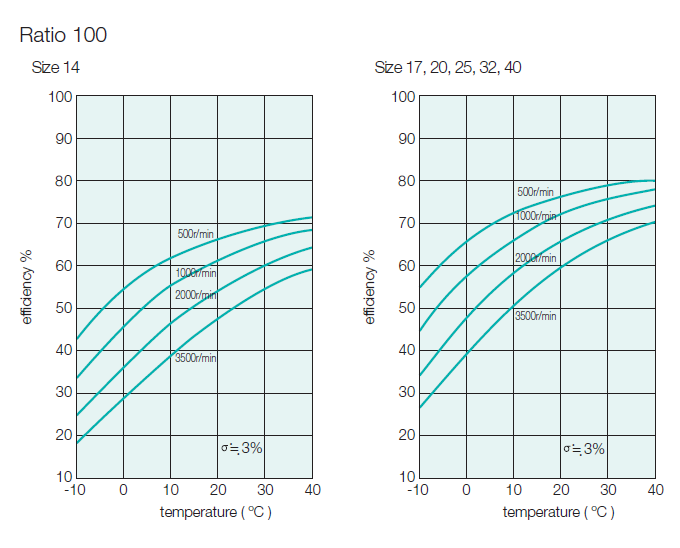
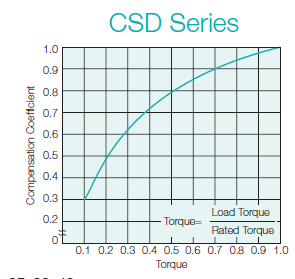
|  |  |
| --- | --- |
| Total Gearbox Torque  Parameters:  Gearbox damping:  SEA Spring const:  Gearbox ratio:  Gains for gearbox:  (These should be very high)  Gains for torque control: | Total Motor Torque  Spring Torque    **Inertial Parameters**  Motor rotor:  Gearbox:  Load:  Spring and load: |

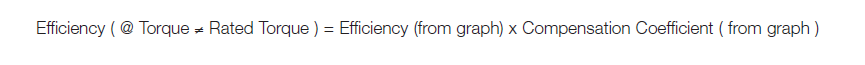
Issues to deal with:

* Modeling encoder resolution. Resolution is expressed in *r*, rad/count. This takes into account the 4x increase from lines to counts using quadrature decoding.

Measured angle = ((round) (actual angle / *r*)) \* *r*

* Limiting the maximum speed of the motor and. To implement this, add viscous damping that starts in at 100% of max speed and rapidly increases from there.
* Gearbox efficiency. Use the data provided by HD systems:





* Motor maximum torque from manufacturer limit.
* Amplifier max current. As a first approximation, it is a hard limit. A better model would be a first order thermal model that has an integrator and decay.
* Add in pure delay to feedback loop.
* Motor speed limit based on back emf constant and voltage.