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**EXPERIMENTS**

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2. Model description:
   * **Parameters estimation experiments: inertias, friction coefficients, torsional spring** ✔️ (old slides)
   * **Model validation experiment** ✔️ (old slides)
   * **Simulator design (screens)**
3. State estimation techniques: filtered derivative, Kalman filter, Sgolai filter (one experiment to compare):
   * **Comparison a-posteriori on model validation experiment­­­❌(3 exps in simulation)**
4. Position control (downright position):
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     2. **PID validation** ✔️
   * *State-feedback controller:*
     1. *Alpha oscillations minimization*
   * Pole Placement (with/without integrator):
     1. **PP validation:**
        + **Static exp high performance polyfit** ✔️ (PP\_down\_0\_static)
        + **Static exp low chattering polyfit** ✔️ **(static\_PP\_down\_2\_polyfit\_2\_120)**
        + **Dynamic exp high performance polyfit** ✔️ (PP\_down\_1\_[polyfit] FAKE o PP\_down\_0)
        + **Dynamic exp low chattering polyfit** ✔️ (PP\_down\_2\_polyfit\_2\_120)
        + **Simulation for chattering motivation:**
          1. *Comparison between High Performance (low settling time, high chattering) vs Low Performance (high settling time, low chattering) and choice operated* **❌ (simulation)**
     2. **PP + Integrator validation (+ discorso tuning integratore mastro magheggio)** ✔️ (PP\_int\_down\_3 HP, PP\_int\_down\_2\_polyfit LP)
   * LQ (with/without integrator):
     1. **LQ validation** ✔️ (LQ\_down\_2 HP, LQ\_down\_4\_polyfit LP)
     2. **LQ + Integrator validation** ✔️ (LQ\_int\_down\_7 HP, ✔️LQ\_int\_down\_8\_polyfit LP)
5. Stabilization of upright position (fake tracking, theta fucks, I care about alpha ass):
   * *Control requirements*
   * PP without integrator:
     1. **PP validation + abuse**  ✔️ (PP\_complete \_up\_3 RUOTA DI SCORTA, abuse\_PP\_up\_3)
   * LQ without integrator
     1. **LQ validation + abuse**  ✔️ (abuse\_LQ\_up\_2)
6. Position control (upright position):
   * *Control requirements*
   * PP (with integrator):
     1. **PP + Integrator validation** ✔️ (PP\_int \_up\_3 HP, PP\_int\_up\_7 HP con int magheggiato, PP\_int\_up\_8 LP, PP\_int\_up 9 MP)
   * LQ (with integrator):
     1. **LQ + Integrator validation** ✔️ **(LQ\_int\_up\_2 HP, LQ\_int\_up\_3 HP con int magheggiato, (LQ\_int\_up\_2\_polyfit HP), LQ\_int\_up\_4 LP, LQ\_int\_up\_5 MP)**
7. Swing up:
   * *Control requirements*
   * Double Switch controller **(+ VIDEO in presentazione):**
     1. Swing up step: bang-bang controller, Lyapunov:
        + **Bang-bang controller validation** ✔️ (new\_swing\_up\_down\_int, to be wrapped/shaped)
        + **Lyapunov controller validation** ✔️ **(swingup\_Lyapunov\_2\_var\_theta\_ref FAST, swingup\_Lyapunov\_5\_var\_theta\_ref FAST more strong control action)**
     2. Stabilization step: PP (without integrator):
        + **Overall controller validation (for the best performing swing up step)**

**For every experiment is needed (on the same plot to save space):**

* **Simulation test vs Real setup test**
* **Simulation Bode vs Real setup Bode**