Lab 5: Non Salient Brushless DC Drive

EE595S

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Part 1:
Non-Salient Current Command Synthesizer

- This part is to be completed by both on and off campus students.
- Consider your machine from the last lab.
- Plot the capability diagram. Similar to Figures 3.3-1 and 3.3-2 of the text.

Part 2:
Simulation of Non-Salient PMSM Drive

- To Be Completed By On-Campus Students
- Parts
  - DC Source = 400 V (Ideal)
  - Non Salient Current Command Synthesizer (You)
  - Delta Modulator (Provided)
  - Inverter (Done – Fix Any Problems)
  - PMSM (To Do)
  - Dynamometer (Provided)

Current Command Synthesizer

- MACRO DEFINITION

  CCS_NSPMSM(z,te_star,wrm,iq_star,id_star, &
  par_vsmx,par_ismx,par_idmn, &
  par_rse, par_lsse, par_lme, par_pe)

- Parameters
  - Based on Your Machine

Delta Modulator (Provided)

- MACRO DEFINITION

  Delta(z,iasst,ibsst,icsst,ias,ibs,ics, &

  sa,sb,sc,par_fsmple)

- For Starters, Use Sampling Frequency of 60 kHz.

PMSM

- MACRO DEFINITION

```
PMSM(z,vax,vbx,vcx,thetarm,wrm,ias,ibs,ics,te, &
        par_rs,par_lq,par_ld,par_lmp,par_np)
```

Dynamometer (Provided) and Mechanical Dynamics

- This is provided. See course web site.

  spdcondyn(z, qrm, wrm, par_wrmstarrpm)

  rotordyn(z,te,tl,qrm,wrm,pqrmic,pwrmic, &
  ptb,pwrmb,pj,pn,palpha,pbeta,pkst)

Studies

- Static Studies
  - Torque Command = 4 Nm
  - Speed: 2500 RPM, 3200 RPM, 3400 RPM
  - Show torque, a-phase current, a-phase current command
- Transient Studies
  - Demonstrate a free acceleration
  - Show torque, a-phase current, a-phase current command, q-axis current command, d-axis current command, and mechanical rotor speed vs time
  - Show torque versus mechanical rotor speed

Deliverables

Part 1

- Graphs of capability curves
- Matlab scripts

Part 2

- All code *.csl, *.cmd, and all of your macros (including ones you did before)
- Do not include my macros
- Results from studies
- 1-2 Paragraph commentary on studies. Discuss points of interest