

# Internal Publication List of

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- **Seagate Internal Technical Presentations.**

1. ***SP-ZAP (Scheduled-Parameter-ZAP): A Written-in RRO (WI-RRO) Compensation Algorithm To Approach Zero Acceleration Path (ZAP).*** Presented at Singapore Science Park, Seagate Technology International. July 1999.
2. ***Frictional Force on the High Precision Servo Control. Presented at The First TEC (Technical Excellence Community) Symposium, 3rd April, 2000. Hotel Inter-Continental, Singapore***

- **Seagate Internal Technical Reports/Memos(\*):<sup>1</sup>**

1. *On a possible new scheme for PES linearization.* 03/99 (6 pages)
2. *\*Linear Cubic PES Linearisation Scheme - Supporting Proof.* 04/99 (1 page)
3. *Case Studies - Comparison between Proximate Time Optimal Control (PTOS) and Variable Structure Control (VSC) for Hard Disk Drives (HDD).* 04/99 (43 pages)
4. *\*Characterization of PES Using TFA (Time-Frequency Approach).* 04/99 (3 pages)
5. *Enhancing Track-Following Performance During Self Servo Writing Via Track-to-Track Iterative Learning Control (T2T-ILC).* 04/99 (11 pages)
6. *A Zero Acceleration Path (ZAP) Compensation Algorithm Using Scheduled Parameters (SP-ZAP).* 06-04-99. (11 pages)
7. *SP-ZAP Implementation Results - Stage-1.* 29-04-99. (6 pages)
8. *SP-ZAP Implementation Results - Stage-2 (Robustifying ZAP Learning Process Via Scheduled Parameters (SP)).* 14-05-99. (4 pages)
9. *Performance Characterization of SP-ZAP for Use with U8. (SP-ZAP: WI-RRO Curve Learning Algorithm Using Scheduled Parameters To Achieve ZAP).* 11-06-99. (16 pages)
10. *Enhanced Adaptive Feedforward Control (EAFC) to Cancel Once-Around Disturbance by Shaping the Internal Model.* 08/99. (14 pages)
11. *An Efficient Sensorless Rotational Vibration and Shock Compensator (RVSC) for Low End Hard Disk Drives with Higher TPI.* 09/99. (15 pages)
12. *Performance Characterization of Rotational Vibration/Shock Compensator (RVSC) - Testing Results on a Dedicated Rotational Shaker.* 09/99. (40 pages)
13. *RVSC: Shock Compensation Performance.* 09-14-1999. (11 pages)
14. *Effects of ZAP and RV/Shock Compensators on Normal Track Following Performance.* 09/99. (13 pages)
15. *RVSC Performance Characterization Using Inject Sine Disturbance via the VCM DAC.* 09-23-1999. (9 pages)
16. *Optimal Parsimonious Repetitive Learning Control for Enhancing Track-Following Performance of Low-end Hard Disk Drives.* 10/99. (27 pages)
17. *Results for Combined Compensators of PRLC (Parsimonious Repetitive Learning Compensator) and RVSC (Rotational V Vibration/Shock Compensator).* 10/99. (6 pages)

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<sup>1</sup> Softcopies are available at SP-SPDD (SP Servo Product Development Database). SP=Science Park. Contact Mr K K Ooi ([kiankeong\\_ooi@notes.seagate.com](mailto:kiankeong_ooi@notes.seagate.com)) for a copy **internally**.

18. *Optimizing the Stability Margin for PRLC (Parsimonious Repetitive Learning Compensator)*. 10/99. (16 pages)
19. *\*SP-ZAP against PES impulses*. 27/10/99. (3 pages)
20. *An Investigation of Track-squeeze Induced by SP-ZAP (SP-ZAP: Scheduled-Parameters Zero Acceleration Path Algorithm)*. 15/11/99. (40 pages)
21. *Track-squeeze Induced by SP-ZAP: Further Drive-Level Results*. 30/11/99. (18 pages)
22. *1F-Component Removal From RROZAP Table Using Optimal Zero-Phase Band-Stop Filtering*. 24/11/99. (3 pages)
23. *Should We Remove 0F-Component From RROZAP Table? A Study on the de-mean ZAP table effect*. 9/12/99. (4 pages)
24. *Memo on the Finalized Scheme for SP-ZAP*. 13/12/99. (4 pages)
25. *U8/PES - drive data display/analysis*. 15/04/99. (5 pages)
26. *U8 NRRO Spectrums Comparison for BW 600 Hz and BW 800 Hz*. 19/11/99. (4 pages)
27. *SP-ZAP Memo: Consistency of the learned RROZAP tables at the same track for different runs and the repeatability of the learned RROZAP tables at consecutive tracks*. 22/12/99. (9 pages)
28. *Should We Learn RROZAP Table Always From Zero?* 30/12/99. (3 pages)
29. *Design for U6: 1F-Component Removal From RROZAP Table Using Optimal Zero-Phase Band-Stop Filtering*. 11/01/2000. (6 pages)
30. *Drive Level Shock Disturbance Simulator - An Extension to Lv3Cmd"P"*. 20/01/2000. (3 pages)
31. *Drive Level Compensation of Bad Track-Splice Effects Using SP-ZAP*. 30 March 2000. (8 pages).
- 32.** *A Cost-effective SP-ZAP Scheme With Neighboring-Track Assistance*. 28 Jan 2000, Revised 31 Jan 2000. (6 pages)
33. *OT issue due to 1x AFC under strong RV : duplication and fixe*. 14 March 2000. (2 pages)
34. *Frictional Force and Its Challenges on High Precision Servo Control of Hard Disk Drive With High TPI*. *Speaker: Ding Mingzhong Prepared by: Ding Mingzhong, Chen Yangquan, Ooi Kiankeong*. Servo Product Development Group, Seagate Science Park R&D Center, March 6, 2000. EEE/NTU, TECH WEEK 2000. Invited Talk. REPORT ref# 2000/233 @ SP Servo Product Development Data Base. See also [http://www.ntu.edu.sg/eee/events/E3\\_week/Precision\\_abstract.html#1](http://www.ntu.edu.sg/eee/events/E3_week/Precision_abstract.html#1)
- 35.** *U8/V8/U10 typical Bode plots*. April 7, 2000. REPORT ref# 2000/242.
36. *Feedforward Scheme to Cancel 930Hz PES Oscillation during Seek Settling Due to Arm or Coil Bending Mode*. 22 Feb. 2000. REPORT ref# 2000/273. (with M. Z. Ding and L. L. Tan) (11 pages)
37. *Acoustic Improvement for Short PTOS Seek*. 22 Feb. 2000. REPORT ref# 2000/274. (with M. Z. Ding and K. K. Ooi) (9 pages)
38. *Drive Level Results for the Proposed and Implemented "Local Smooth Jerk (LSJ) Seek"*. REPORT ref# 2000/278. (with M. Z. Ding and K. K. Ooi) (9 pages)
39. *Techniques for Improving Seek-settling by Selective Multiple Active Damping Schemes Against Plural Resonance Frequencies*. May 19, 2000. (with M. Z. Ding and K. K. Ooi) (10 pages)
40. *New RVSC ppt slides (15 slides)*. Aug. 7, 2000.
41. *An introduction to RVSC (13 slides)*. Aug. 3, 2000.
42. *Tuning knobs of RVSC (rotational vibration/shock compensator) and how to tune them - U6 as an example*. Aug. 3, 2000. (4 pages)
43. *A brief guide on how to apply mini-shaker to perform RV tests*. Aug. 3, 2000. (4 pages)
- 44.** *After SP-ZAP Learning or During SP-ZAP Learning? A Study on the Time-Domain 1F-Component Removal From RROZAP Table*. Nov. 24, 1999. (2 pages)
- 45.** *"Method to Improve the Compensation for Written-in Error in A Hard Disk Drive"*, June 6, 2000. (7 pages) (with Liu X., Lim C.K., Ooi K.K. and Bi, Q)

46. "PES Frequency and Magnitude Dependent Scheduling of Q-filter's Relative Degree in RVSC (Rotational Vibration and Shock Compensator)", Aug. 4, 2000. (9 pages) (with KK Ooi, MZ Ding, LL Tan, SQ Min)
47. "Identification and Cancellation of Cage Frequency in a Hard Disc Drive", July 05, 2000. (14 pages) (with KK Ooi, X. Liu, WW Yeo, WS Lee and BW Quak)
48. "A Hybrid Scheme for Written-in RRO (repeatable runout) Compensation With Adjustable Track-Squeeze Improvement ", August 8, 2000. (6 pages) (With MZ Ding, KK Ooi, SQ Min, X. Liu, and Eric WS Lee)
49. "SP-ZAP error tolerance on consecutive bad track-ID W/R values", 31 August 2000. (5 pages). (with WeiSung Lee Eric, and KianKeong Ooi)
50. "Tips for SP-ZAP Learning Gain Tuning on U6", 11 September 2000 (1 pages).
51. "Remove2f for U6 SP-ZAP", 13 September 2000. (3 pages)
52. "An Investigation of SP-ZAP improvement rate 1-sigma variations". 13 Sept. 2000. (3 pages)
53. "Remove2f for U6 SP-ZAP", 13 September 2000. (3 pages)
54. Learned RROZAP table consistency and REMOVE2f/3f - U6 drive level results. 19 Sept. 2000. (3pages)
55. Memo on SP-ZAP table gain (TG). 20 Sept. 2000. (3pages)

- **Code Contributions**

- **Siemens-C166 ASSEMBLY**

- Level3 command "P" for (shock) disturbance simulator. Renovation of "P" command at Level3/4 for *half sine shock*, *rectangular shock*, and *triangular shock*. Duration and G-level can be specified via serial port command "P" at Level3/4.
- Level4 command "B" for SP-ZAP (Scheduled Parameter-Zero Acceleration Path).
- Level4 command "R" for RVSC (Rotational Vibration/Shock Compensator)
- Level4 command "N" for PRLC (Parsimonious Repetitive Learning Compensator)

- **ANSI C**

- Zero-phase/IIR filtering (smoothing for packwriter PES eval). C-version of MATLAB FILTER and FILTFILT.

- **MATLAB Scripts**

- Zero Phase FIR Filtering.
- Simulation of PES Cubic Linearization Scheme
- Q-filter Design for Disturbance Observer.
- Q-filter Design for Repetitive Learning Control.
- Savitzky-Golay smoothing filter
- FIR Double-Digital-Differentiator (FIR-DDD)
- IIR Digital-Differentiator Design
- FIR Digital-Differentiator Design
- And many more.

- **ProCOMM Scripts**

- RRO/NRRO SNR Screening
- ZAP Learning Performance Screening
- Etc.

- **Other SP-SPD Data Base Contributions (Titles only, not my own work!):**

1. NUS/EE/PhD: Adaptive Neural Network Control: Design, Stability, Performance, by Zhang, Tao. REPORT ref # 2000/263.
2. Computer shock and vibrational concerns, by Tom Irvine. REPORT ref # 2000/261.
3. B. D. O. Anderson's point of view on the futures of adaptive control. REPORT ref # 2000/258.

4. NRRO-feedforward compensation drive level results by Zhang, Tao. REPORT ref # 2000/257.
5. Longmon RROZAP. REPORT ref # 2000/246.
6. 166 FFT. REPORT ref # 2000/245.
7. TRACK-ID for RROZAP. REPORT ref # 2000/244.
8. TMR defined in Science Park. REPORT ref # 2000/239.
9. PES linearization and ZAP performance. REPORT ref # 2000/243.
10. STCO considerations: bad track splice issues. REPORT ref # 2000/236.
11. UMaryland/MS: An investigation of control strategies for friction compensation, by N. E. Ehrich. REPORT ref # 2000/214.
12. EPFL/PhD: Friction modeling, identification and compensation by F. Altpeter. REPORT ref # 2000/213.
13. Track-ID for SP-ZAP. REPORT ref # 2000/183.
14. 100+RLC papers. REPORT ref # 2000/173.
15. Alan Nagl's rotational and vibration lecture notes. REPORT ref # 2000/172.
16. Industrial perspectives on robust control: application for storage systems, by M. Steinbuch and M. L. Norg. REPORT ref # 2000/108.
17. UC Berkeley/ME/PhD: Adaptive servo schemes using micromachined accelerometers for increased disturbance rejection in magnetic hard disk drives, by S. S. Pannu. REPORT ref # 2000/91.
18. 12/1999. IEEE CDC. Papers related to HDD Servo. REPORT ref # 2000/78.
19. Okayama Univ./PhD: Improving control performance of a pneumatic manipulator and shock absorption in impact force control, by Ismail Altuncu. REPORT ref # 2000/72.
20. Notes on VSC by Jian-Xin Xu. REPORT ref # 2000/70.
21. MIT/ME/PhD: Time optimal input shaping, by T. D. Tuttle. REPORT ref # 2000/66.
22. Input Shaping MATLAB Toolbox by T. D. Tuttle. REPORT ref # 2000/65
23. CMU/ME/PhD: Advanced HDD control, by Y H Huang. REPORT ref # 2000/52
24. UC Berkeley/PhD: Control techniques for increased disturbance rejection and tracking accuracy in magnetic disk drives, by M. T. White. REPORT ref # 2000/50/
25. NTU/EEE/PhD: High-order iterative learning control: convergence, robustness and applications, by Y Q Chen. REPORT ref # 2000/49.
26. AWBT References (Antiwindup and Bumpless Transfer), 9 PDF files.
27. *Drive level RRO ZAP and Self Servo RRO ZAP* (Results of Dr Bi Qiang). REPORT ref#2000/264.
28. PID Tuning Techniques: Dr Bi, Qiang's selected paper collection. June 15,2000. 6 PDF files.
29. *Learning Control Papers Presented at The 3<sup>rd</sup> Asian Control Conference*. July 17, 2000. URL
30. *Enhancement of Controller Design for Mechatronic Motion Systems* by René Waarsing. M.Sc. Thesis Supervisors: Prof. dr. ir. J. van Amerongen Dr. ir. T.J.A. de Vries Dr. ir. J. van Dijk Ir. H.J. Coelingh January 1999 002R99 Control Laboratory Electrical Engineering Department University of Twente P.O. Box 217 7500 AE Enschede The Netherlands. July 21,2000. 1 PDF file.
31. *Track Following Control of a High Performance Disc Drive* by John C. Morris. Seagate Technology, 8001 E. Bloomington Freeway, Bloomington, MN 55420, John C [Morris@notes.seagate.com](mailto:Morris@notes.seagate.com), October 6, 1998. July 25,2000. 1 PDF file.
32. Linear fractional-order controllers (FOC: e.g.  $PI^{\alpha}D^{\beta}$ ). Aug. 02,2000. 2 PDF files.
33. Bobsled uActuator on U10 by Dr Zhang Tao. Aug. 4, 2000.
34. HDD servo related papers at American Control Conference (ACC'2000). Aug. 14, 2000.
35. *Interpolation, Decimation and Compression techniques for RROZAP tables*. Aug. 16, 2000. (J C Morris's disclosures on ZAP)

36. *A paper on FOC*. Sept. 1, 2000. (From Ing. Ivo PETRAS, PhD. Department of Informatics and Process Control BERG Faculty, Technical University of Kosice B. Nemcovej 3, 042 00 Kosice, Slovak Republic, phone: +421 95 6025172, e-mail: [petras@tuke.sk](mailto:petras@tuke.sk))
37. *An RLC paper by R W Longman*. (ICARCV'2000) (/Track Following/RLC).
38. *Linearization by functional inversion*. (/Thesis/paper)
39. *Legend font size by a factor*. (/MATLAB/Tools.)