

# EEPE 6357: Simulation, Modeling, and Control of Power Electronic Systems Spring 2026

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**Office Location:** ECSN 3.504  
**Office Hours:** T/R, 1:00-3:00 PM  
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**Course Time:** Tues/Thu (4:00-5:15 pm)  
**Course Location:** ECSN 2.110  
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## **Course Description**

This course is structured into three parts. The first part of the course deals with averaging and generalized averaging methods used in modeling of dc-dc and dc-ac power converters. The second part of the course focuses on design of linear controllers, stability issues such as non-minimum phase response, effects of constant power loads, and stability in cascaded converters. This part also includes examples of nonlinear control such as feedback linearization and sliding mode control. The last part of the course explores the nonlinear dynamics in power converters. This includes, limit cycling, quasi-periodic, route to chaos and bifurcation, and methods to avoid chaos in dc-dc converters.

## **Course Purpose**

To develop an in-depth knowledge of transient behaviors in power electronic converters and power electronic-based systems. It also provides a system level understanding with emphasis on micro-grid and electrified transportation systems. Applications of advanced control and signal processing in control of power converters will be another outcome for students.

## **Prerequisite:**

Graduate standing in EE and consent of the instructor.

## **Course Text:**

[1] Nonlinear Phenomena in Power Electronics, By: Banerjee et. al., Wiley-IEEE Press.(978-0-7803-5383-1)

\* In addition, the instructor will provide handouts as needed.

## **Grading:**

Class Participation and Homework: 20%

4 Mini-Projects: 80%(Each 20%)

{A:(90%-100%),B:(80%-89%),C:(70%-79%), D:(50%-69%), F: (0-49%)}

## **Policy:**

There is a **zero tolerance** policy in regards to **plagiarism**. Copying of homeworks, reports, and other assignments from classmates or World Wide Web constitutes academic dishonesty. Instructor will report academic dishonesty to judicial affairs of the UT-Dallas.

## List of supporting papers for EEPE 6357

All papers are available on <http://ieeexplore.ieee.org/>

1. S. Singer, "Realization of loss-free resistive elements," *IEEE Transactions on Circuits and Systems*, vol. 37, no. 1, Jan. 1990.
2. S. Sanders, J. Noworolski, X. Liu, and G. Verghese, "Generalized averaging method for power conversion circuits," *IEEE Transactions on Power Electronics*, vol. 6, no. 2, April 1991.
3. J. Hung, W. Gao, and J. Hung, "Variable structure control: a survey," *IEEE Transactions on Industrial Electronics*, vol. 40, no. 1, Feb. 1993.
4. P. Mattavelli, L. Rossetto, G. Spiazzi, and R. Tenti, "General-purpose sliding-mode controller for DC/DC converter applications," *24<sup>th</sup> Annual IEEE Power Electronics Specialist Conference*, Jun. 1993.
5. J. Ackermann and V. Utkin, "Sliding mode control design based on Ackermann's formula," *Proceedings of the 33<sup>rd</sup> Conference on Decision and Control*, Dec. 1994.
6. G. Hua and F. Lee, "Soft-switching techniques in PWM converters," *IEEE Transactions on Industrial Electronics*, vol. 42, no. 6, Dez. 1995.
7. A. Bhat, "A generalized steady-state analysis of resonant converters using two-port model and Fourier-series approach," *IEEE Transactions on Power Electronics*, vol. 13, no. 1, Jan. 1998.
8. M. Bellar, T. Wu, A. Tchamdjou, J. Mahdavi, and M. Ehsani, "A review of soft-switched DC-AC converters," *IEEE Transaction on Industry Applications*, vol. 34, no. 4, Aug. 1998.
9. A. Emadi and M. Ehsani, "Negative impedance stabilizing controls for PWM DC/DC converters using feedback linearization techniques," *35<sup>th</sup> Intersociety Energy Conversion Engineering Conference and Exhibit*, Jul. 2000.
10. C. Morel, J. Guignard, and M. Guillet, "Sliding mode control of DC-to-DC power converters," *9<sup>th</sup> International Conference on Electronics, Circuits and Systems*, 2002.
11. Y. Shtessel, A. Zinober, and I. Shkolnokov, "Boost and Buck-Boost power converter control via sliding modes using dynamic sliding manifold," *Proceedings of the 41<sup>st</sup> IEEE Conference on Decision and Control*, Las Vegas, Dec. 2002.
12. H. Sira-Ramirez, "Sliding mode- $\Delta$  modulation control of a "Buck" converter," *Proceeding of the 42<sup>nd</sup> IEEE Conference on Decision and Control*, Maui, Dec. 2003.
13. A. Emadi, "Modeling and analysis of multiconverter DC power electronic system using the generalized state-space averaging method," *IEEE Transactions on Industrial Electronics*, vol. 51, no. 3, June 2004.
14. R. Jayabalan, B. Fahimi, A. Koenig, and S. Pekarek, "Applications of power electronics-based systems in vehicular technology: state-of-the-art and future trends," *IEEE 35<sup>th</sup> Power Electronics Specialists Conference*, 2004.
15. C. Rivetta, A. Emadi, G. Williamson, R. Jatabalan, and B. Fahimi, "Analysis and control of a buck DC-DC converter operating with constant power load in sea and undersea Vehicles", *IEEE Transaction on Industry Applications*, vol. 42, no. 2, March 2006.