

# Modeling and Control Design of DC/DC Converters

The Inn at Virginia Tech and Skelton Conference Center

August 3-7, 2015

## DESCRIPTION:

**Dr. Fred C. Lee**, CPES Director, and **Dr. Dushan Boroyevich**, CPES Co-Director, are the short course instructors. The course will engage engineers in a combined lecture/laboratory instructional format, providing hands-on experience in the DC/DC converter analysis, modeling, simulation, control design and frequency domain measurement techniques.

With individual step-by-step guidance in the lab, participants will learn through simulation and measurements how to solve design problems using current-injection control and voltage-mode control, and will see the impact of loop gain design on closed-loop performances such as stability margins, small-signal and large signal dynamics, output impedance and audio susceptibility. Attendees will gain a clear understanding of power converter control through exercises such as determining dc and ac characteristics of power stages.

The short course will cover:

### **DC and steady-state analysis of PWM converters**

- Forward and flyback converter
- DC characteristics
- PWM controller operation

### **Modeling and analysis of PWM converters**

- Average modeling of PWM converters
- Small-signal modeling of PWM converters
- Open-loop small-signal and transient characteristics

### **Single-loop control for PWM converters**

- Loop-gain, phase and gain margins
- Design of single-loop compensator
- Closed-loop, small signal and transient characteristics

### **Peak current-mode control systems**

- Design of current-mode control
- Design of the voltage compensator with current-mode control
- Closed-loop small signal and transient characteristics

### **Advanced current-mode control**

- Peak current-mode control using standardized control module (SCM)
- Average current-mode control
- Charge control

## ADDITIONAL INFORMATION

- Registration on Monday & continental breakfast – start at 7:30 a.m. outside lecture room
- Short course lectures -- begin at 8 a.m. in Cascades Room, The Inn at Virginia Tech (2<sup>nd</sup> level)
- Short course dinner – all participants are invited to join group dinner on Monday
- Lunch on own (Monday through Thursday) -- Preston's @ Inn at VT, or nearby restaurants
- Pizza lunch on Friday - Instructor will wrap-up by mid-afternoon to allow departure for airport

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## COURSE FEES:

\$1,600 Principal Plus, Principal, Associate Members

\$2,500 Affiliate Members

\$3,500 Non-Members

## REGISTRATION (Deadline: July 24, 2015):

<http://www.cpe.vt.edu/reg/cpes-mcd/>

## VENUE:

**Lectures:** Cascades Room, The Inn at Virginia Tech & Skelton Conference Center (901 Prices Fork Road)

**Lab Sessions:** 253 Whittemore Hall (1185 Perry Street, Virginia Tech campus, within walking distance)

## LAB SESSION ORGANIZATION

Due to limited lab space, the maximum enrollment is 32, with participants organized in 2 lab groups. Please see below the lecture and lab schedules:

| LECTURE SCHEDULE (Groups A & B)  |
|--|
| Monday - 8 a.m. - 12 p.m.   1 p.m. - 5 p.m. (6:30 p.m. - Short Course Dinner at Sal's Restaurant)                  |
| Tuesday - 8 a.m. - 12 p.m.   |
| Wednesday - 8 a.m. - 12 p.m.   |
| Thursday - 8 a.m. - 12 p.m.  |
| LAB SCHEDULE (GROUP A)   |
| Tuesday - 1 p.m. - 5 p.m.  |
| Wednesday - 1 p.m. - 5 p.m.  |
| Thursday - 1 p.m. - 5 p.m.   |
| Friday – CPES Lab Tour: 10 a.m. - 12 p.m.   Pizza Lunch: 12 p.m. - 1 p.m. (654 Whittemore Hall)   1 p.m. – 3 p.m.  |
| LAB SCHEDULE (GROUP B)   |
| Tuesday - 6 p.m. - 10 p.m.   |
| Wednesday - 6 p.m. - 10 p.m.   |
| Thursday - 6 p.m. - 10 p.m.  |
| Friday - 8 a.m. - 10 a.m.   CPES Lab Tour: 10 a.m. - 12 p.m.   Pizza Lunch: 12 p.m. - 1 p.m. (654 Whittemore Hall) |

***Please send email to <tshaw@vt.edu> to indicate your lab group preference -- first come first served!***

## LODGING:

**The Inn at Virginia Tech and Skelton Conference Center (Booking deadline: July 3, 2015):**

**CPES contact:** Teresa Shaw | Phone: 540-231-4527 | Fax: 540-231-6390 | E-mail: [tshaw@vt.edu](mailto:tshaw@vt.edu)

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901 Prices Fork Road, Blacksburg, VA 24060 | <http://www.innatvirginiatech.com>

Group Rate: \$131.00 single/double

**Reservation: 540-231-8000 / 877-200-3360; Booking Code: "Modeling and Control Design of DC/DC Converters"**

**Or online at: <https://bookings.ihotelier.com/bookings.jsp?groupID=1194775&hotelID=75607>**

**Hilton Garden Inn Blacksburg (Booking deadline: July 2, 2015):**

900 Plantation Rd, Blacksburg, Virginia, 24060 | Phone: 540-552-5005

Group Rate: \$119.00 single/double

**Reservation: [www.blacksburg.hgi.com](http://www.blacksburg.hgi.com) | Promo code: "MCD"**

## ADDITIONAL LODGING OPTIONS

**Comfort Suites University:** <https://www.choicehotels.com/virginia/blacksburg/comfort-suites-hotels/va493>

**Courtyard by Marriott Blacksburg:** <http://www.marriott.com/hotels/travel/roabl-courtyard-blacksburg/>

**Main Street Inn Blacksburg:** <http://www.hotelblacksburg.com/>

**Comfort Inn Blacksburg:** <https://www.choicehotels.com/virginia/blacksburg/comfort-inn-hotels/va125>

## TRANSPORTATION

**Airport:** Roanoke Regional Airport (ROA); about 45 miles away

**Car Rental:** <http://www.roanokeairport.com/ground-transportation>

**Roanoke Airport Transportation Service:** (Door-to-Door, \$66 each way)

Phone: (800) 288-1958 <http://www.roanokeats.com/>

**Smartway Bus:** (Stop is at Squires Student Center on campus; \$4 each way, exact change required)

<http://www.smartwaybus.com/>

Download Schedule:

<http://www.smartwaybus.com/documents/FINAL-smartwayschedule-FINAL020915.pdf>

## DIRECTIONS

<http://www.maps.vt.edu/directions.html>

**Interactive Campus Map:** <http://www.maps.vt.edu/interactive/>