University of Colorado Boulder

Input Filter Design

This course is part of **Modeling and Control of Power Electronics Specialization**

Instructor: Dr. Dragan Maksimovic

7,132 already enrolled

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3 modules
Gain insight into a topic and learn the fundamentals.

4.7 ★
(41 reviews)

Intermediate level
Some related experience required

Flexible schedule
1 week at 10 hours a week
Learn at your own pace

Build toward a degree
Learn more

What you'll learn

- ✓ Understand conducted electromagnetic interference (EMI) and the need for input filter
- ✓ Understand input filter design principles based on attenuation requirements and impedance interactions.
- ✓ Design properly damped single-stage and damped multi-stage input filters.
- ✓ Use computer-aided tools and simulations to verify input filter design

Skills you'll gain

Power Electronics | Control Systems | Electrical Systems | Design Strategies | Electronics | Electrical Engineering | Electronic Systems | Computer-Aided Design | Design Specifications | Simulation and Simulation Software | Technical Design | View less skills

Details to know

Shareable certificate
Add to your LinkedIn profile

Taught in English
22 languages available

Assessments
1 quiz, 8 assignments

See how employees at top companies are mastering in-demand skills

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Build your subject-matter expertise

This course is part of the **Modeling and Control of Power Electronics Specialization**
When you enroll in this course, you'll also be enrolled in this Specialization.

- Learn new concepts from industry experts
- Gain a foundational understanding of a subject or tool
- Develop job-relevant skills with hands-on projects
- Earn a shareable career certificate

There are 3 modules in this course

This course can also be taken for academic credit as ECEA 5707, part of CU Boulder's Master of Science in Electrical Engineering degree.

This is Course #3 in the Modeling and Control of Power Electronics course sequence. After completion of this course, you will gain an understanding of issues related to electromagnetic interference (EMI) and electromagnetic compatibility (EMC), the need for input filters and the effects input filters may have on converter responses. You will be able to design properly damped single and multi-section filters to meet the conducted EMI attenuation requirements without compromising frequency responses or stability of closed-loop controlled power converters.

We strongly recommend students complete the CU Boulder Power Electronics specialization as well as Courses #1 (Averaged-Switch Modeling and Simulation) and #2 (Techniques of Design-Oriented Analysis) before enrolling in this course (the course numbers provided below are for students in the CU Boulder's MS-EE program):

- Introduction to Power Electronics (ECEA 5700)
- Converter Circuits (ECEA 5701)
- Converter Control (ECEA 5702)
- Averaged-Switch Modeling and Simulation (ECEA 5705)
- Techniques of Design-Oriented Analysis (ECEA 5706)

After completing this course, you will be able to:

- Understand conducted electromagnetic interference (EMI) and the need for input filter
- Understand input filter design principles based on attenuation requirements and impedance interactions.
- Design properly damped single-stage input filters.
- Design properly damped multi-stage input filters.
- Use computer-aided tools and simulations to verify input filter design

Read less

Introduction to Input Filter Design

Module 1 • 4 hours to complete

Module details

Introduction to electromagnetic interference, the need for input filtering, and the input filter effects

What's included

11 videos | 7 readings | 1 quiz | 3 assignments | 1 discussion prompt

Hide info about module content

11 videos • Total 99 minutes

Introduction to Electromagnetic Compatibility (EMC) and Interference (EMI) • 12 minutes

Differential and Common-Mode EMI • 7 minutes

EMI Measurement and Simulation Example • 24 minutes

Addition of Input Filter to a Converter • 4 minutes

Impedance Interactions • 12 minutes

Approaches to Input Filter Design • 9 minutes

Overview of MATLAB and Spice examples • 9 minutes

Control-to-Output Transfer Function with Input Filter • 3 minutes

Determination of ZD and ZN • 4 minutes

Input Filter Design Criteria • 8 minutes

Corner Frequencies • 3 minutes

7 readings • Total 50 minutes

Non-Credit Students: Welcome and Where to Find Help • 10 minutes

Introduction to the Course • 10 minutes

Accessing & Using MATLAB • 10 minutes

Accessing & Using LTspice • 5 minutes

Course MATLAB & LTspice Examples • 10 minutes

Understanding EMI and Mitigating Noise in DC/DC Converters • 0 minutes

MATLAB and LTspice examples • 5 minutes

1 quiz • Total 60 minutes

Introduction to Input Filter Design • 60 minutes

3 assignments • Total 80 minutes

Practice Problem: LISN and EMI • 20 minutes

Practice Problem: Effects of Input Filter • 30 minutes

Practice Problem: ZN, ZD, and Frequency Responses • 30 minutes

1 discussion prompt • Total 10 minutes

Introduce Yourself • 10 minutes

Single-Stage Input Filter Design

Module details

Module 2 • 3 hours to complete

Design of single-section damped input filters

What's included

5 videos 3 assignments

Hide info about module content

5 videos • Total 53 minutes

Introduction to Input Filter Damping • 6 minutes

Parallel RC Damping • 14 minutes

Damping Networks • 1 minute

Optimum Damping • 19 minutes

Optimum Damping: Summary of Results • 10 minutes

3 assignments • Total 150 minutes

Single Stage Input Filter Design • 90 minutes

Practice Problem: Damped Cb-Rf Input Filter, Large Cb • 30 minutes

Practice: Optimally Damped Cb-Rf Input Filter • 30 minutes

Multi-Stage Input Filter Design

Module details

Module 3 • 3 hours to complete

Design of multiple-section damped inputs filters

What's included

3 videos 2 assignments

Hide info about module content

3 videos • Total 28 minutes

Multi-Stage Cascaded Filters • 7 minutes

Cascaded Filter Design Example • 19 minutes

Input Filter Design Summary • 1 minute

2 assignments • Total 180 minutes

Multi Stage Input Filter Design • 90 minutes

Practice Problem: Multi-Stage Input Filter Design • 90 minutes

Earn a career certificate

Add this credential to your LinkedIn profile, resume, or CV. Share it on social media and in your performance review.

Build toward a degree

This course is part of the following degree program(s) offered by University of Colorado Boulder. If you are admitted and enroll, your completed coursework may count toward your degree learning and your progress can transfer with you.[1]

View eligible degrees

Instructor

Instructor ratings 4.8 ★ (13 ratings)

Dr. Dragan Maksimovic
University of Colorado Boulder
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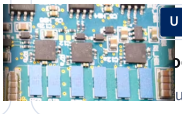

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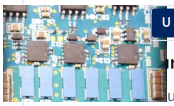

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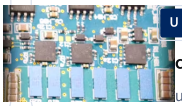

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5 stars	80.48%
4 stars	17.07%
3 stars	0%
2 stars	0%
1 star	2.43%

YS

★ 4 · Reviewed on Mar 23, 2021

Good stuff. If it only didn't have many mistakes in the materials...

SN

★ 5 · Reviewed on Jul 23, 2025

Amazing teaching, Professor made the concepts very easy to understand

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Frequently asked questions

When will I have access to the lectures and assignments?

To access the course materials, assignments and to earn a Certificate, you will need to purchase the Certificate experience when you enroll in a course. You can try a Free Trial instead, or apply for Financial Aid. The course may offer 'Full Course, No Certificate' instead. This option lets you see all course materials, submit required assessments, and get a final grade. This also means that you will not be able to purchase a Certificate experience.

What will I get if I subscribe to this Specialization?

When you enroll in the course, you get access to all of the courses in the Specialization, and you earn a certificate when you complete the work. Your electronic Certificate will be added to your Accomplishments page - from there, you can print your Certificate or add it to your LinkedIn profile.

Is financial aid available?

Yes. In select learning programs, you can apply for financial aid or a scholarship if you can't afford the enrollment fee. If fin aid or scholarship is available for your learning program selection, you'll find a link to apply on the description page.

More questions

Visit the learner help center

Financial aid available, learn more

Skills

- Artificial Intelligence (AI)
- Cybersecurity
- Data Analytics
- Digital Marketing
- English Speaking
- Generative AI (GenAI)
- Microsoft Excel
- Microsoft Power BI
- Project Management
- Python

Certificates & Programs

- Google Cybersecurity Certificate
- Google Data Analytics Certificate
- Google IT Support Certificate
- Google Project Management Certificate
- Google UX Design Certificate
- IBM Data Analyst Certificate
- IBM Data Science Certificate
- Machine Learning Certificate
- Microsoft Power BI Data Analyst Certificate
- UI / UX Design Certificate

Industries & Careers

- Business
- Computer Science
- Data Science
- Education & Teaching
- Engineering
- Finance
- Healthcare
- Human Resources (HR)
- Information Technology (IT)
- Marketing

Career Resources

- Career Aptitude Test
- Examples of Strengths and Weaknesses for Job Interviews
- High-Income Skills to Learn
- How Does Cryptocurrency Work?
- How to Highlight Duplicates in Google Sheets
- How to Learn Artificial Intelligence
- Popular Cybersecurity Certifications
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