Discover Viterbi: Aerospace & Mechanical Engineering with Professor Julian Domaradzki

Viterbi School of Engineering
University of Southern California
Fall 2017
WebEx Quick Facts

Will I be able to get a copy of the slides after the presentation?

YES!

How can I ask a question during the information session?

1. Using the Q&A Panel, type a question in the box below the Ask drop-down menu.
2. Select a recipient from the Ask drop-down menu.
3. Click Send. We will respond as soon as we are able.
Today’s Program

- University of Southern California
- USC Viterbi School of Engineering
- Aerospace & Mechanical Engineering
  - Program Overview
  - Application Criteria
- DEN@Viterbi
- Tuition & Fees
- Q&A
The University of Southern California

- Oldest Private University in the western U.S.
  - Founded in 1880
- 44,000 Students
  - 19,000 Undergraduates | 25,000 Graduates
- 4,190 Full-time Faculty
- Diverse Student Population
- Located in Los Angeles
Viterbi School at a Glance

**Academic Departments**
- 8 Academic Departments

**Faculty**
- 185 tenure-track faculty
- 20+ members of the National Academy of Engineering
- 60+ NSF CAREER, National & Presidential Young Investigator

**Student Populations**
- 2,700 Undergraduate
- 5,600 Graduate students

**Research**
- Leader in funded research
- 45+ Research Centers
- More than $185M in annual research expenditures

**Alumni**
- More than 65,000+
Best Engineering Graduate Schools

- Top Ranked Graduate Engineering Program

Best Online Graduate Engineering Programs

- Ranked #1 Online Graduate Engineering Programs
- Ranked #1 Online Computer Information Technology Program (Computer Science)

Best Online Graduate Engineering Programs for Veterans

- Ranked #1 Online Graduate Engineering for Veterans
- Ranked #1 Online Computer Information Technology for Veterans
USC Engineering: Points of Distinction

- International Reputation for Excellence
- The Trojan Family Network: 65,000+ engineers strong
- Unique engineering programs available: Online, on site & on campus
- Complete range of programs
  - PhD, Masters and Bachelors
  - Graduate Certificates
  - Short Courses
  - Custom Programs
The Viterbi School of Engineering: A Leader in Research

Viterbi School is a consistent leader in funded research in the U.S.

- Highly interdisciplinary research environment
- Diverse research areas as robotics, software engineering, sensor networks, vision sciences, automated construction and photonics
- Over 45 research centers
- Industrial partnerships and collaboration
Meet Professor Julian Domaradzki

Professor Julian Domaradzki
• Professor & Chairman, Department of Aerospace and Mechanical Engineering
• Research in turbulence theory, turbulence modeling and numerical simulations of fluid flow
• Research work has been supported by organizations such as the Office of Naval Research (ONR), the Department of Energy (DOE), NASA’s Jet Propulsion Laboratory (JPL) and the National Science Foundation (NSF).
• Fellow of the American Physical Society (APS) and associate fellow of the American Institute of Aeronautics and Astronautics (AIAA)
Aerospace & Mechanical Engineering

AME research thrusts:
1. Biodynamical Engineering
   (Keck, Michelson, Huntington)

2. Energy Engineering
   (Chevron, Tesla, Port of LA, DWP)

3. Autonomous systems, robotics and advanced manufacturing
   (Virgin Orbit, Haas, Epson, EOS, Stratasys)

4. Aerospace systems and technologies
   (Boeing, SpaceX, Northrop Grumman, Lockheed-Martin)
Aerospace & Mechanical Engineering

Traditional disciplinary strengths
Combustion and reacting flows, fluid mechanics, dynamical systems, advanced manufacturing, robotics.

Numbers

- 20 Faculty + 14 Joint Appointments + 7 Full-Time Lecturers
- 479 undergraduates (18% of VSoE), 450 graduate students (8% of VSoE)
- ~$20M in active external research funding

Student groups

- AIAA student design projects
  - National success (placed 3rd, 1st, 3rd, 1st, ..) in last 5 years
- Design-build-fly
  - National success (placed highly most years -- always fun)
- Formula SAE
Aerospace & Mechanical Engineering – MS Programs

- MS in Aerospace Engineering
- MS in Aerospace & Mechanical Engineering (Computational Fluid & Solid Mechanics)
- MS in Aerospace & Mechanical Engineering (Dynamics and Control)
- MS in Mechanical Engineering
- MS in Mechanical Engineering (Energy Conversion)
- MS in Product Development Engineering

Available online via DEN@Viterbi
MS in Aerospace Engineering – Program Details

Required Engineering Analysis Courses (6 units)
AME 525 | Engineering Analysis
AME 526 | Engineering Analytical Methods

Required Core Specialization Track - One core specialization track must be selected from the following list - number of units vary by track. Specialization electives are also required.

- Aerodynamics/Fluid Dynamics
- Aerospace Controls
- Aerospace Design
- Aerospace Structures
- Computational Fluid Dynamics
- Propulsion Specialization
MS in Aerospace & Mechanical Engineering (Computational Fluid & Solid Mechanics) – Program Details

Required Core Courses (21 units)

- AME 404 | Mechanical Engineering Problems
- AME 509 | Applied Elasticity OR CE 507
- CE 507 | Mechanics of Solids OR AME 509
- AME 525 | Engineering Analysis
- AME 526 | Engineering Analytical Methods
- AME 530a | Dynamics of Incompressible Fluids
- AME 535a | Introduction to Computational Fluid Mechanics
- CE 529a | Finite Element Analysis

Technical Elective (3 units) - One course from this list is required:

- AME 511 | Compressible Gas Dynamics
- AME 516 | Convection Processes
- CE 541a | Dynamics of Structures
- CE 542a | Theory of Plates

Computational Technical Elective (3 units) - One course from the following:

- AME 535b | Introduction to Computational Fluid Mechanics
- CE 529b | Finite Element Analysis
- MASC 575 | Basics of Atomistic Simulation of Materials
- MASC 576 | Molecular Dynamics Simulations of Materials and Processes
MS in Aerospace & Mechanical Engineering (Dynamics & Control) – Program Details

Required Core Courses (21 units)
- AME 525 | Engineering Analysis
- AME 526 | Engineering Analytical Methods
- AME 521 | Engineering Vibrations II
- AME 522 | Nonlinear Vibrations
- AME 524 | Advanced Engineering Dynamics
- AME 541 | Linear Control Systems II
- AME 552 | Nonlinear Control Systems

Elective Courses (6 units)
Elective courses can be chosen in areas of specific interest to the student such as orbital dynamics, spacecraft control, aircraft dynamics and control, chaos and chaotic dynamics, random vibrations, computer control of mechanical systems and robotics. The program provides the graduate student with a broad, well-rounded, advanced education that can be applied to many specific, technologically advanced fields in which dynamics and control play a pivotal role.
Required Engineering Analysis Courses (6 units)
- AME 525 | Engineering Analysis
- AME 526 | Engineering Analytical Methods

Required Core Specialization Track One core specialization track must be selected and requires four core courses (12 units), two required engineering analysis courses (AME 525 and 526 – 6 units), two core electives (6 units), and one engineering elective (3 units) by advisement.
- Thermal and Fluid Sciences Track with an Emphasis in Combustion, Fluid Dynamics, or Heat Transfer
- Engineering Design Track
- Mechanics and Materials
- Microelectromechanical Systems (MEMS)
- Dynamics and Control
MS in Mechanical Engineering (Energy Conversion) – Program Details

**Required Engineering Analysis Courses (21 units)**
- AME 430 | Thermal System Design
- AME 525 | Engineering Analysis
- AME 526 | Engineering Analytical Methods
- AME 577 | Survey of Energy and Power for a Sustainable Future
- AME 578 | Modern Alternative Energy Conversion Devices
- CE 501 | Functions of the Constructor
- SAE 515 | Sustainable Infrastructure Systems

**Approved Elective Courses (6 units)**
*Students are encouraged to consider electives from other Sustainable Infrastructure Systems programs.*
- AME 513 | Principles of Combustion
- AME 514 | Applications of Combustion and Reacting Flows
- AME 581 | Introduction to Nuclear Engineering
- ENE 505 | Energy and the Environment
**Required Core Courses (6 units)**
- AME 503 | Advanced Mechanical Design
- ISE 545 | Technology Development and Implementation

**Required Core Specialization Track**
Students will choose one area of specialization (track):

**Product Development Systems Required Courses (6 units)**
- ISE 515 | Engineering Project Management
- ISE 544 | Management of Engineering Teams

**Product Development Technology Required Courses (6 units)**
- AME 505 and AME 525 or AME 526 are required
- AME 505 | Engineering Information Modeling
- AME 525 | Engineering Analysis OR AME 526
- AME 526 | Engineering Analytical Methods OR AME 525

**Engineering Electives (9 units)**
Approved (by advisement) 400-, 500-, or 600-level engineering courses

**Deficiency Courses**
Depending on the student’s educational background some deficiency courses may be required to complete the degree.
- AME 420 | Engineering Vibrations
- AME 451 | Linear Control Systems I
Dual Degree Program Offerings

Dual Degree Programs

• MS in Aerospace Engineering/Engineering Management
• MS in Mechanical Engineering/Engineering Management

- All applicants must meet the admission requirements of both the Department of Aerospace and Mechanical Engineering and the Department of Industrial and Systems Engineering;
- A minimum of 48 units is required; A minimum of 18 units must be graduate-level course work in Aerospace & Mechanical Engineering, approved by a graduate advisor;
- A dual degree requires a total of 48 units;
- Dual degree programs are available online via DEN@Viterbi and on-campus.
Application Criteria for Master’s Degree Programs

- Undergraduate degree (Bachelor of Science) in engineering, math, or hard science from a regionally-accredited university
- To be competitive, a cumulative undergraduate GPA of at least 3.0 on a 4.0 scale is recommended
- Satisfactory scores on the general portion of the Graduate Record Examination (GRE) that are less than five years old
- Resume/CV (Required)
- Supplemental Materials:
  - Statement of Purpose (Required)
  - Letters of Recommendation (Optional)
- TOEFL (International Applicants)

Please visit https://viterbigradadmission.usc.edu/ame/ for complete requirements
Application Deadlines

Application Deadlines for 2018

Fall 2018

- Deadline to submit all required materials: January 17, 2018*
- Deadline for Scholarship Consideration (on-campus only): December 15, 2017

Spring 2019

- Deadline to submit all required materials: September 15, 2018*
- Deadline for Scholarship Consideration (on-campus only): August 31, 2018

* A deadline extension for DEN@Viterbi applicants may be available. Please email DEN@Viterbi.usc.edu for more information.

Helpful Links:

- List of DEN@Viterbi Programs: http://viterbi.usc.edu/DENDegrees
- USC Graduate Application: https://usc.liaisoncas.com
Course Delivery Methods

Methods of Course Delivery

• On-campus, full time
  3 classes per semester
  1.5 – 2 years to complete

• Online delivery via DEN@Viterbi
  1-2 classes per semester
  2.5 – 3 years to complete degree
How DEN@Viterbi Works

The Viterbi School of Engineering uses a state-of-the-art, proprietary web-based delivery system that enables students from around the world to access classes live or on-demand.

DEN@Viterbi Students:

- View the same lectures as on-campus students, with fresh content every semester
- Participate in highly interactive discussions with professors and peers
- Submit homework electronically
- Take exams at proctored testing centers near their home or work (or at USC if in the Los Angeles area)
## DEN@Viterbi Overview

<table>
<thead>
<tr>
<th></th>
<th>DEN@Viterbi Student</th>
<th>On-Campus Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Admission</td>
<td>USC Graduate Application &amp; required materials</td>
<td>USC Graduate Application &amp; required materials</td>
</tr>
<tr>
<td>Weekly Course Lectures</td>
<td>Online with Interactivity</td>
<td>On USC’s Campus</td>
</tr>
<tr>
<td>Online Course Archives (Lectures &amp; Course Documents)</td>
<td>✓</td>
<td>✓ *</td>
</tr>
<tr>
<td>Assignments</td>
<td>Submit electronically according to course deadlines</td>
<td>Submit during lecture or lab according to course deadlines</td>
</tr>
<tr>
<td>Exams</td>
<td>Proctored location</td>
<td>USC’s campus</td>
</tr>
<tr>
<td>Courses per Semester (Average)</td>
<td>1-2</td>
<td>3-4</td>
</tr>
<tr>
<td>Degree Completion Requirements</td>
<td>27-37 units with a 3.0 GPA or above</td>
<td>27-37 units with a 3.0 GPA or above</td>
</tr>
<tr>
<td>USC Diploma (No Distinction)</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

*DEN@Viterbi Sections Only*
DEN@Viterbi’s E-Learning System

DEN@Viterbi Classroom
DEN@Viterbi’s E-Learning System
DEN@Viterbi’s E-Learning System

Helium Porosity vs. Air Permeability

- Used to select porosity cut-offs, for reservoir rocks.
- Based on permeability values.
Student Interactivity & Group Meetings

- All DEN@Viterbi students are provided access to their own meeting rooms which can be used for several purposes:
  - Enable video communication (web and mobile)
  - Integrate phone conferencing
  - Integrate fixed room IP video systems
  - Desktop sharing
  - Set up meetings with faculty, teaching assistants and peers

- Call in during live lectures

- Participate in live chats and threaded discussion boards
DEN@Viterbi

Question: Is there any difference between earning a Master’s degree on campus vs. via DEN@Viterbi?

Answer: NO. DEN@Viterbi is a delivery method. Students adhere to the:
- Same Admission Criteria
- Same Curriculum
- Same Exams and Homework
- Same Academic Standards and Graduation Requirements

Therefore...

You earn the same diploma whether you earn the degree on-campus or online through DEN@Viterbi.
DEN@Viterbi Additional Info

- Limited Status
  - Allows strong candidates to begin coursework before formal admission.
  - Courses (maximum of 12 units) can be applied toward degree program once admitted but limited status does not guarantee admission.
  - Get Started: https://viterbigradadmission.usc.edu/denviterbi/getting-started/

- Tuition Deferment Program
  - Students supported by company can defer “up front” payment of tuition until after the semester is over.
  - Company must pay 75-100% of tuition to be eligible for program.
  - For additional information: https://viterbigrad.usc.edu/tuition-and-funding/employer-supported
## Tuition & Fees (2017-2018)

### Example of tuition and fees for a DEN@Viterbi Student

<table>
<thead>
<tr>
<th>PER-COURSE FEES</th>
<th>Unit Cost</th>
<th>Tuition for 3-Unit Course</th>
<th>Tuition for 4-Unit Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition for 500/600 level course</td>
<td>$1,937</td>
<td>$5,811</td>
<td>$7,748</td>
</tr>
</tbody>
</table>

Degree Programs are 27-36 units (9-11 courses)

For an overview of additional fees, please visit: [https://viterbigradadmission.usc.edu/programs/masters/tuition-funding/tuition-funding-masters/](https://viterbigradadmission.usc.edu/programs/masters/tuition-funding/tuition-funding-masters/)
Getting Started

For those interested in taking classes on campus:

- Visit USC campus
- Start your application:
  http://www.usc.edu/admission/graduate/apply

For those interested in taking classes online via DEN@Viterbi:

- Start as a Limited Status Student in Spring 2018 –or–
- Start your application:
  http://www.usc.edu/admission/graduate/apply
Contact Us

USC Viterbi School of Engineering
Graduate & Professional Programs

On Campus: viterbi.gradprograms@usc.edu
DEN@Viterbi: DEN@Viterbi.usc.edu

213.740.4488

http://viterbi.usc.edu/gradprograms