Free Application for Graduate Study

Application Requirements
- Graduate Record Examination (GRE)
- Letters of Recommendation
- Personal Statement

To apply online:
- http://graduateapplications.vanderbilt.edu/engineering.asp
- http://www.engineering.vanderbilt.edu
The choice of where you will do your graduate work is one of the most important decisions you will make as an adult. The university you choose should not only give you the educational and research foundation you need, but should help you build the quality of life you desire in the future.

At Vanderbilt, you will work with professors who are world renowned in their research fields. And not just engineering professors—we pride ourselves on our rich tradition of multidisciplinary research at Vanderbilt. Our research partners within the university include the Vanderbilt School of Medicine, Owen Graduate School of Management, and numerous College of Arts and Science departments including physics, psychology, chemistry, biology, and earth and environmental sciences.

We don’t stand on ceremony—we open doors. We work with universities around the world as well as world-class corporations on cutting-edge research that ultimately saves lives and improves the conditions of life.

But don’t expect to be cast into the sea of opportunities without an anchor. The School of Engineering is a solid community. We know each other and we help each other. Even our faculty “stars” are deeply committed to teaching and working with the next generation of engineering students. You can expect to enjoy the richness of collaboration and long-term relationships that our professors themselves enjoy.

We offer depth, breadth and agility in graduate engineering education. This brochure is intended as an introduction—to what we are working on and to a handful of the hundreds of students and faculty who are making exciting things happen here at the Vanderbilt University School of Engineering.

We hope you’ll come visit us in person and see for yourself.

VANDERBILT ENGINEERING FAST FACTS

- Doctoral/research intensive institution
- Graduate student/faculty ratio: 5-1
- Graduate student population: approximately 390

- Graduate programs:
  - Biomedical Engineering
  - Chemical Engineering
  - Civil Engineering
  - Computer Science
  - Electrical Engineering
  - Environmental Engineering
  - Environmental Science and Environmental Management
  - Interdisciplinary Materials Science
  - Mechanical Engineering

- Vanderbilt graduate engineering programs in the top 50 (U.S. News ranking):
  - Biomedical Engineering, tied at 21st
  - Chemical Engineering, tied at 44th
  - Civil Engineering, tied at 46th
  - Computer Engineering, tied at 43rd
  - Electrical Engineering, tied at 49th
  - Environmental Engineering, tied at 37th
  - Mechanical Engineering, tied at 44th

The Vanderbilt School of Engineering tied for 43rd overall, up four places from 2006.

The Vanderbilt School of Engineering ranks in the top 15 in the nation when compared with other research-extensive, Ph.D.-granting universities with fewer than 100 tenured and tenure-track engineering school faculty.
Vanderbilt is one of the pioneers in the nation in biomedical engineering and was one of the first in the country to establish a biomedical engineering department. We continue to lead the field not only in selected research areas (see below) but in redesigning bioengineering education, itself.

We work very closely with the Vanderbilt School of Medicine, which is within a 25-yard walk from our building. Among many notable partnerships with the School of Medicine is our participation in the Vanderbilt University Institute of Imaging Science, which has one of the world’s most powerful research magnets. We also work with the Free-Electron Laser, which is one of a handful of tunable electron lasers in the world.

**PROFILE: JONATHON WELLS**
(expects to obtain his Ph.D. in 2007)

**Research area**: Biomedical optics. My research exploits a novel method for nerve stimulation that uses pulsed infrared laser light for contact-free, damage-free, artifact-free stimulation of discrete populations of neural fibers. By optimizing key laser parameters and unraveling underlying mechanisms of action, a laser stimulator with unmatched precision may soon be a new clinical tool in medical procedures.

**Undergraduate degree from**: Vanderbilt University

**Outside interests/activities**: I play golf and basketball, and I’m a regular user of Vanderbilt’s extensive recreational and exercise facilities.

**Why Vanderbilt**: I chose Vanderbilt primarily because of the great experience I had as an undergraduate. Great people in a beautiful campus within a fun city.

**Likes best about Vanderbilt Engineering**: The School of Engineering strives for a collaborative atmosphere, within the School and with other university departments, which leads to new and exciting research opportunities. Also, the professors here are focused on education and teaching in addition to their research areas of expertise.

**RESEARCH AREAS: BIOMEDICAL ENGINEERING**

- Image and signal analysis
- Imaging systems to guide surgery and other therapies
- Magnetic resonance imaging
- Analysis of nervous system signals
- Biomedical optics
- Laser-tissue interaction
- Spectroscopy for diagnosis of cancer and other diseases
- Cellular bioengineering
- Endothelial function, capillary permeability and gene therapy
- Learning science/technology
- BioMEMS: instrumenting the single cell
- Computational modeling
- Biomaterials/tissue engineering/drug delivery

**RESEARCH SNAPSHOT**

Producing bone-on-demand: Assistant Professor Prasad Shastri is part of an international team that has pioneered a technique to persuade the body to produce bone in one area that can be harvested and used to repair damaged bone in another location.
Vanderbilt has not only kept pace with the ongoing worldwide transformation of the chemical engineering field, but our researchers have established international leadership and prominence in key areas. Our faculty are particularly strong in the fields of high-performance nanoscale and biological materials, cellular and tissue engineering, surface engineering, computational nanoscience, molecular modeling and simulations, semiconductors and microelectronic devices, drug delivery, polymer thin films, and adsorption technology.

Interdisciplinary research takes a high priority at Vanderbilt, especially in Chemical Engineering. Our faculty and students work closely with researchers in other engineering departments and collaborate with research groups throughout Vanderbilt in the natural sciences and medicine. We play integral roles in such groups as the Vanderbilt Institute of Nanoscale Science and Engineering and the Vanderbilt Institute of Chemical Biology.

PROFILE: ANDREA HAFEMAN
(expects to obtain her Ph.D. in 2009)

**Research area:** Chemical engineering, bioengineering. I am working on injectable bone scaffolds for use in bone defects such as fractures from trauma, surgery or/and osteoporosis. These scaffolds are biocompatible and biodegradable and contain various growth factors to promote bone healing. The patient's own bone cells grow into the scaffold, after which the scaffold biodegrades to leave only the healed bone.

**Undergraduate degree from:** Princeton University

**Outside interests/activities:** Tennis and dance

**Why Vanderbilt:** I chose Vanderbilt because I was very interested in the research of Professor Scott Guelcher on the development of polymeric biomaterials for bone tissue engineering.

**Likes best about Vanderbilt Engineering:** I really like the interdisciplinary cooperation between various engineering departments as well as with other science departments and the medical school. The opportunity to use the resources and collaborate with the faculty has been invaluable.

RESEARCH SNAPSHOT

Peter T. Cummings, John R. Hall Professor of Chemical Engineering, has developed one of the most accurate computer models of water ever created. One of the leading international experts in molecular modeling, Professor Cummings and his associates are also working with researchers in the Cancer Biology department of the Vanderbilt Medical Center to develop cancer-cell-based mathematical models of cancer tumors, with a particular emphasis on the invasion process whereby cancer spreads to other parts of the human body.
Civil and environmental engineers tackle complicated and challenging problems that have a major impact on people. At Vanderbilt, civil and environmental engineering education and research are based on reliability and risk management principles, and the department is an international leader in the risk and reliability engineering field.

**PROFILE: ROBERT F. GURATZCH**
(expects to obtain his Ph.D. in 2007)

**Research area:** Civil engineering: sensor placement optimization under uncertainty for structural health monitoring systems. Our methodology will help accurately assess the damage, reliability, risk, and remaining life of structures such as buildings, bridges, and flight vehicles.

**Undergraduate degree from:** Rose-Hulman Institute of Technology

**Outside interests/activities:** Water sports, mountain biking, weight lifting, and college football; travel abroad and across state lines; painting; downtown Nashville adventures!

**Why Vanderbilt:** As soon as I stepped onto campus, I was immediately attracted to the look and feel of Vanderbilt. Having attended the small, private, all-engineering, all-undergraduate Rose-Hulman for my B.S. degree, I saw certain similarities between the two schools that made me comfortable: the relative size of the student body, building architecture, reputation, and all of the beautiful green spaces. During my campus visit, the faculty spent significant amounts of time with me and several current students showed me a wonderful time on campus and in Nashville.

**Likes best about Vanderbilt Engineering:** I enjoy the fact that I’m such an integral part of the Civil and Environmental Engineering department. The department values the opinions of all its members—faculty, researchers, students, assistants and administrators—and includes us all in the decision and policy-making process. Also, the students are like a “family” and have built a community that makes working and researching a fun and enjoyable experience. I love that when I get up in the morning, I look forward to coming to campus!

**RESEARCH AREAS: CIVIL ENGINEERING**
- Reliability and risk-based engineering
- Structural mechanics and advanced materials
- Multi-scale computational mechanics
- Multi-scale/multi-physics damage modeling
- Fatigue and fracture of advanced composite materials
- Environmental durability of advanced nano-composite materials
- Structural health monitoring and control
- Transport and remediation in soils, sediments, groundwater and surface water
- Transportation and infrastructure security
- Incident management
- Infrastructure vulnerability information management systems

Professor of Civil and Environmental Engineering Sankaran Mahadevan is a world leader in structural reliability research, developing methods for adaptive simulation, systems reliability analysis, probabilistic finite element analysis, and reliability-based optimization. His research is being used to design and evaluate many critical systems including aerospace structures, roadway and bridge maintenance, nuclear waste disposal, and hydraulic structures.
**RESEARCH SNAPSHOT**

Professor of Civil and Environmental Engineering and Chair of the Department David S. Kosson co-directs the national multi-university Consortium for Risk Evaluation with Stakeholder Participation. CRESP works to advance cost-effective cleanup of the nation’s nuclear weapons production facility waste sites by improving the scientific and technical basis of environmental management decisions and policies. Vanderbilt is the lead institution of CRESP, which is funded in part by a grant from the Department of Energy.

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**PROFILE: JANEY SMITH**

(expects to obtain her Ph.D. in 2008)

**Research area:** Water quality, environmental engineering. I am working to integrate water quality models with Geographic Information Systems to create a comprehensive water quality management and emergency response system.

**Undergraduate degree from:** Tennessee Technological University

**Outside interests/activities:** Hiking, photography, softball, all sorts of art, gardening, just about anything outdoors.

**Why Vanderbilt:** I chose Vanderbilt because of its excellent reputation and my interest in theoretical learning and modeling research. I enjoy applied engineering, but I wanted the opportunity to explore the theoretical aspects. I plan to teach one day, and I expect that my Vanderbilt degree will be advantageous in my job search.

**Likes best about Vanderbilt Engineering:** I enjoy the small class sizes and the interaction with the professors. I also enjoy teaching the undergraduates and have enjoyed participating in their education as a TA. Another perk is the high quality of guest speakers we attract.

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**RESEARCH AREAS: ENVIRONMENTAL ENGINEERING**

- Nuclear waste management
- Environmental remediation
- Contaminant behavior in aquatic and subsurface systems (soils, sediments, groundwater and surface water)
- Leaching processes and assessment
- Environmental assessments and risk management
EECS is the largest department in the School of Engineering, as measured by the number of faculty and amount of externally sponsored research awards. These highly productive faculty are also the professors who teach our undergraduate and graduate classes; the co-joined passions for research and education are a hallmark of the Vanderbilt environment.

Our department is a dynamic and growing community of scholars active in most of the principal areas of our field. Our faculty members are diverse and participate in many interdisciplinary initiatives. The two largest research areas within the department are the Institute for Software Integrated Systems and the Institute for Space and Defense Electronics. These institutes include about one-third of the department faculty, as well as a large number of professional staff who are engaged in leading-edge research of significant importance to critical commercial and government systems. Other significant research programs include diamond and carbon-based nanotechnology, robotics and human-computer interactions, medical image processing, artificial intelligence, computer graphics and animation, neuroscience, software engineering, computer networking and network security, and materials science.

PROFILE: JAMES HILL
(expect to obtain his Ph.D. in 2009)

Research area: Quality-of-service enabled middleware and model-driven engineering, computer science.

Undergraduate degree from: Morehouse College

Outside interests/activities: National Society of Black Engineers, Organization of Black Graduate and Professional Students, VIBE (hip-hop dancing), traveling, and hanging with friends.

Why Vanderbilt: Out of all the programs that accepted me, Vanderbilt was the only program that offered an M.S. in conjunction with a Ph.D. Vanderbilt was also the most welcoming of all the schools I visited. I met a majority of the faculty and got a closer look at their computer science program. This helped me to realize that I would get the most opportunity at Vanderbilt. The faculty were enthusiastic and made me feel that if I came to Vanderbilt I would reach my true potential, and pursue an area of my interest with the most support. Finally, I’m from Nashville, so the location was a plus.

Likes best about Vanderbilt Engineering: It’s a great social atmosphere in addition to a great place to learn and do research. The people here understand the need for a balance between work and play. Whether they host a graduate social to release tension and relax or invite students to a holiday event, they create an atmosphere that promotes success because they understand the needs and wants of their students.

RESEARCH SNAPSHOT

Assistant Professor of Electrical Engineering Sharon M. Weiss is developing optoelectronic devices, biosensors, and other applications using optical components. Here she is aligning a laser beam to perform photoluminescence measurements, which characterize the performance of our hybrid porous silicon/light emitting nanocrystal LEDs.

RESEARCH AREAS: COMPUTER SCIENCE

- Algorithms and systems
- Artificial intelligence
- Cognitive modeling
- Computer animation
- Computer graphics
- Computer networking and network security
- Human-machine teaming
- Hybrid and embedded real-time systems
- Intelligent learning environments
- Machine learning
- Medical imaging
- Middleware
- Model-integrated computing
- Software engineering
- Visual information processing
RESEARCH AREAS: ELECTRICAL ENGINEERING

- Circuit design
- Diamond and carbon nanotechnologies
- Electronic materials
- Human-machine teaming
- Hybrid and embedded real-time systems
- Image processing
- Intelligent learning environments
- Medical imaging
- Model-integrated computing
- Optical properties of semiconductors
- Photonics and biosensing
- Radiation effects
- Robotics
- Solid state and microelectronics
- Visual information processing

PROFILE: DANIEL LOVELESS

(expects to receive his master’s in May 2007 and will continue in Ph.D. program)

Research area: Radiation effects and reliability, electrical engineering and computer science. My research focuses on the impact of radiation on computer circuitry, particularly in the space environment. I am examining the effects of single ions on radio-frequency circuits and am developing methods to “harden” circuits to protect them from this type of radiation.

Undergraduate degree from: Georgia Institute of Technology

Outside interests/activities: Writing music, swimming.

Why Vanderbilt: The research group I work with has an excellent international reputation. My wife did research at Vanderbilt as an undergraduate and is now studying biomedical engineering. Vanderbilt was a good choice for both of us.

Likes best about Vanderbilt Engineering: It is an honor and a pleasure to work with the people here. They are at the top of their field and they are highly supportive of my ideas.

RESEARCH SNAPSHOT

Professor of Electrical Engineering Robert A. Weller is using Vanderbilt’s high-performance computing resources to develop a revolutionary system for analyzing the reliability of electronics in radiation environments, such as space. The computing cluster consists of more than 1400 processors served by tens of terabytes of disk space, and backed up by a robotic tape storage system.
Faculty and graduate students of the Vanderbilt Department of Mechanical Engineering are engaged in a variety of intriguing, leading-edge research topics. Our faculty have earned national and international reputations in selected fields and have developed highly collegial environments for research and education.

**Profile: Vishnu Mallapragada**
(expects to obtain his Ph.D. in December 2007)

**Research area:** Medical robotics and robotic rehabilitation. I am working to develop robotic devices that can help aged and disabled people during therapy sessions. I am also working on ultrasound imaging technology that can guide needle insertion during breast tumor biopsies to increase precision and decrease pain and tissue damage.

**Undergraduate degree from:** Indian Institute of Technology, Madras

**Outside interests/activities:** Golf, hiking, crossword puzzles, nonfiction.

**Why Vanderbilt:** The doctoral program in mechanical engineering at Vanderbilt allowed me to get into research quickly without having to do a lot of course work. The department also has excellent research facilities and top-notch faculty. My research interests meshed well with the research being done in the department.

**Likes best about Vanderbilt Engineering:** The School of Engineering is a great community of students and faculty. It offers a very good graduate program that includes research opportunities in diverse fields. Also there is a lot of interaction between various departments and research groups, which fosters a stimulating, creative atmosphere.

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**Research Snapshot**

H. Fort Flowers Professor Dongqing Li is working on chips that will serve as portable laboratories capable of on-the-scene diagnosis of diseases and rapid detection of biochemical warfare agents. He plans for these lab-on-a-chip devices to be used directly in the field by police, emergency medical technicians, security personnel and hazardous waste materials assessors.

**Research Areas: Mechanical Engineering**
- Biomechanics
- Combustion and propulsion
- Computational mechanics
- Intelligent mechatronics
- Human-robot interaction
- Lab-on-a-chip technology
- Laser diagnostics of combustion
- Materials science
- Microfluidics
- Microscale heat transfer
- Nanoscale thermo-fluid
- Robotics
Vanderbilt University recognizes that materials science is the underpinning of the development of new technologies. Faculty from chemistry, physics, materials engineering, chemical engineering, electrical engineering, mechanical engineering, and civil engineering have come together to create this intensely collaborative enterprise in both teaching and research in the field.

The Interdisciplinary Program in Materials Science develops and studies electronic materials, magnetic materials, superconducting materials, nanostructured materials, molecular engineering and science, surface and interface science, thin films, surface modification, radiation effects in solid state devices, organic-based devices, materials synthesis, solidification, materials characterization, and materials physics.

**PROFILE: JOHN RIGUEUR**

(expects to obtain his Ph.D. spring 2010)

**Research area:** Investigating carbon nanotube growth for future device applications.

**Undergraduate degree from:** Fisk University

**Outside interests/activities:** Sports, traveling, painting, drawing, music, skydiving.

**Why Vanderbilt:** I was drawn to the interdisciplinary Ph.D. program in materials science and engineering through the Fisk-Vanderbilt Ph.D. Bridge Program and the Vanderbilt Institute of Nanoscale Science and Engineering.

**Likes best about Vanderbilt Engineering:** I am attracted by the productiveness and professionalism of the faculty and students, as well as the scope of interdisciplinary research in the field of nanotechnology.

**RESEARCH SNAPSHOT**

Associate Professor of Electrical Engineering and Computer Science Jim Wittig is using electron microscopy to characterize magnetic materials. He is one of some 40 faculty members involved in the Interdisciplinary Program in Materials Science at Vanderbilt.

**RESEARCH AREAS: MATERIALS SCIENCE**

- Carbon nanostructures for devices
- Cellular-nanostructure interface
- Characterization of nanoscale materials
- Effects of nanoscale confinement on fluid transport
- Energy transfer in nanoscale devices
- Fluorescent nanocrystals for disease detection and neuroscience
- Linear and nonlinear optical properties of metal nanoparticle composites
- Metal carbon nanocomposites as fuel cell catalysts
- Nanoparticles for drug delivery
- Nanoscale surface patterning with finely focused ion beam
- Radiation damage in nanodevices
- Spintronics in nanostructured materials
- Structural phase transitions in nanocrystalline metal oxides
- Structure and properties of nanocomposites
Center for Intelligent Mechatronics
Center for Intelligent Systems
Center for Technology-Guided Therapy
Consortium for Risk Evaluation with Stakeholder Participation
Institute for Software Integrated Systems
Institute for Space and Defense Electronics
Laser Diagnostics and Combustion Group
Radiation Effects and Reliability Group
Vanderbilt Center for Environmental Management Studies
Vanderbilt Engineering Center for Transportation Operations and Research
Vanderbilt Institute for Integrative Biosystems Research and Education
Vanderbilt Institute of Imaging Science
Vanderbilt Institute of Nanoscale Science and Engineering
Vanderbilt-Northwestern-Texas-Harvard/MIT (VaNTH) Engineering Research Center for Bioengineering Educational Technologies

VANDERBILT’S SCHOOL OF ENGINEERING IS ALSO HOME TO

- Biomedical Modeling Laboratory
- Biomedical Optics
- Computational Science: Atomic Structure Calculation
- Laser Diagnostics and Combustion Group
- Medical Image Processing Laboratory
- Tennessee Space Grant Consortium

For a detailed description of each center, please see:
http://frontweb.vuse.vanderbilt.edu/vuse_web/researchpages/researchCenter.htm
The Vanderbilt engineering graduate programs are highly competitive. We are looking for students with proven academic prowess as well as demonstrated personal character and ambition. Our decision is based on evaluation of each applicant’s complete record, including Graduate Record Examination scores, transcripts, and letters of recommendation. **Application is free online:** [http://graduateapplications.vanderbilt.edu/engineering.asp](http://graduateapplications.vanderbilt.edu/engineering.asp)

**INCOMING ENGINEERING GRADUATE STUDENTS:**

**Graduate Record Examination**
- Verbal — 550-800
- Quantitative — 760-800
- Writing — 4.5-6.0

**Grade Point Average (GPA):** 3.6-4.0

**DEGREE OPTIONS**

**Doctor of Philosophy (Ph.D.)**
- Recognition of high attainment in a special field of knowledge
- Preliminary, qualifier and dissertation defense

**Master of Science (M.S.)**
- Graduate-level course of study
- Focus on engineering research
- Usual continuation toward Ph.D.
- “Topping up” fellowships for Ph.D.’s

**Master of Engineering (M.Eng.)**
- Graduate-level course of study
- Focus on engineering design
- Terminal degree program
- Limited financial opportunities

**STUDENT SUPPORT**

Doctoral candidates can expect to receive service-free awards that will pay all or part of tuition as well as a supplemental income stipend ranging from $17,000 to $30,000 per year for teaching assistants and research assistants. Individual fellowships, such as University Graduate Fellowships, National Science Foundation, and IBM fellowships, are also available.

In addition, departments may provide medical insurance and typically will cover activities and recreation fees, which cover admission to most sporting, social and cultural events on campus. (Discounted tickets are available for events not covered.)

**ASSISTANTSHIPS**

**Teaching Assistantships**
- Financial support provided by department
- Main responsibility is to assist instructors
- Continuing support is contingent upon academic progress and good evaluation
- Teaching assistantships are short-term support; priority is given to new incoming graduate students

**Research Assistantships**
- Financial support provided by individual faculty members through research grants
- Main responsibility is to assist faculty members with the research project
- Continuing support is contingent upon academic and research progress and availability of funds

**DATES TO REMEMBER**

**January 15:** Application and all supporting documents due

**March 31:** Admission offers for fall semester mailed to applicants

**April 15:** Responses to offers of admission due

If your reply is not received by April 15, the department may reallocate any offer of financial award.

Spring admissions: Most departments do not admit students for the spring semester. Please check with the specific program before applying.

**Additional Information**
[http://www.vanderbilt.edu/catalogs/grad/Grad01.html](http://www.vanderbilt.edu/catalogs/grad/Grad01.html)
[http://frontweb.vuse.vanderbilt.edu/vuse_web/](http://frontweb.vuse.vanderbilt.edu/vuse_web/)
[http://frontweb.vuse.vanderbilt.edu/vuse_web/gradpages/index.htm](http://frontweb.vuse.vanderbilt.edu/vuse_web/gradpages/index.htm)
[https://graduateapplications.vanderbilt.edu/engineering.asp](https://graduateapplications.vanderbilt.edu/engineering.asp)

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Free Application for Graduate Study

Application Requirements
  t  Graduate Record Examination (GRE)
  t  Letters of Recommendation
  t  Personal Statement

To apply online:
  t  http://graduateapplications.vanderbilt.edu/engineering.asp
  t  http://www.engineering.vanderbilt.edu