

Mechanical Engineering Computing Resource Handbook

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Welcome!

As a new Mechanical Engineering student at UMBC, many computer resources are at your disposal.

This Computing Resource Handbook provides critical information on computing issues ranging from how to create your UMBC computer account to the availability and use of engineering software packages for personal computing instruction and research.

Updates to this document will be posted at <http://www.umbc.edu/engineering/me/it> as they become available. Please also feel free to email meit@umbc.edu at any time with any IT questions or suggestions you may have.

This handbook is broken down in into 3 sections:

- 1) Getting Started
- 2) Frequently Asked Questions
- 3) Specialized Engineering Software Catalog

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Getting Started

As a member of the Mechanical Engineering community you have many computing resources at your fingertips. In our department, we have many IT resources - from special software to high powered workstations and more - in order to give you best possible experience while at UMBC.

Currently there are two specialized computer labs with high powered graphics and engineering software. These are located in Engineering 114 and ITE 238. Unless a class is being taught, you are free to use the computers in these labs, subject to lab hours of operation. OIT maintains general access labs throughout the Engineering Building and in the basement of the library. These are accessible to all UMBC students and personnel, unless a class is being taught at the time, again, subject to lab hours of operation.

Also, most research labs use computing resources. These computers most often run Windows, although some labs have Linux and Sun workstations.

In this guide you will find many details about computing at UMBC in general and Mechanical Engineering in particular. If at any time you have questions, please email our IT support specialist at *meit@umbc.edu* or visit the help desk in Engineering 020.

Creating your UMBC account

The first thing any new member of Mechanical Engineering needs is a UMBC account. This is also called a “gl” account, an “afs” account or a “MyUMBC” account. If you do not already have one, or have forgotten the password to yours, please visit the OIT helpdesk in Engineering (Formerly ECS) 020. A consultant will be happy to help you set up a new account or change the password on an existing one.

Once you have your UMBC account, please do not forget the username and password for it! This account is the basis for all computing at UMBC, and as such, is very important. A few rules regarding this account that you should be aware of are:

- 1) Never, ever, tell anyone else your password. This is grounds for losing your account. Also, if that person ever does anything deemed improper, you will be held accountable.
- 2) Make sure your password is not easily guessable. Using words or anything that can be found in the dictionary is always a bad idea. A good guideline is that your password should include at least one number and special character. The special characters include “! , @ # \$ % ^ & ~ ” and others. If you follow this recommendation, it will be very hard for anyone to ever “hack” your account.
- 3) These accounts are subject to the Acceptable Use Policy which can be found here: <http://www.umbc.edu/oit> (Click on “Acceptable Use Policy”)

Your UMBC account gives you many advantages. For one, it is also your email account here at UMBC. Your email address will be your username at umbc.edu. An example is that Panos Charalambides, our department chair, has the username of panos. His email then is *panos@umbc.edu* . You can add aliases and such by logging into *http://my.umbc.edu* with your UMBC account and clicking on “Personal” at the top and then reading through the options presented you.

To check your mail you can login to *http://my.umbc.edu* and use the “web mail” feature. This is similar to other web-based email programs like “Hotmail” or “Gmail”. You can also use any standard email client that you prefer. The server names are *imap.umbc.edu* and *smtp.umbc.edu* for IMAP and SMTP servers, respectively.

An Important word about email: Never open any attachments that are sent to you via email. The only exceptions to this should be attachments that you have been told are coming, and are sure that they are meant for you. Most viruses send email that appears to come from someone you know, in order to entice you to open the attachment. It is **always** better and safer to email that person back to ask them if they sent you the attachment first.

Our Disk Server

Mechanical Engineering has a disk server that is maintained for the use of Faculty, Staff and Graduate Students in our department. All Windows machines in the department have been added to the Active Directory here at UMBC. In order to login to these machines you will first need a UMBC account, and then you will need to notify our IT support specialist with your username so that you can be added to the right access lists as well as given account space on the disk server.

Using the disk server from one of the “AD” connected machines is simple. Once you login, your home directory as well as the lab directory of the lab you are associated with will be set to “L:” and “M:”. You will be able to see these under “My Computer”. You can treat them like a normal hard drive and copy, delete, create and transfer files with them.

Using the disk server from Linux is also easy, assuming the linux machine you are using is maintained by our IT support specialist. If your linux machine is personal, directions will be available later on the ME IT web site at <http://www.umbc.edu/engineering/me/it> for using the disk server at UMBC or at home. To use it at UMBC it is as simple as running one of these two commands:

```
/usr/site/bin/menghomes <your_username>  
/usr/site/bin/menglabshares <your_username>
```

The first will mount your home directory and the second your shared lab directory. The “<your_username>” should be replaced with your username. Once run, they will ask for you password. Once you enter it and hit enter, it will mount the directories as /tmp/username or /tmp/username.lab. Username is your username, and the first is your home directory and the second your shared lab directory.

Future updates of these directions, including use from home and Macintoshes will be posted at <http://www.umbc.edu/engineering/me/it>

Blackboard

An important tool used in classroom instruction at UMBC is Blackboard. Blackboard is a web portal allowing instructors to post information, grades and homework in a way that is easily accessible to all students. Our blackboard site is at <http://blackboard.umbc.edu> or you can access it once you login to MyUMBC.

Information on usage and tutorials can be found at <http://blackboard.umbc.edu> by clicking on the “Blackboard Help” tab at the top of the page.

Using UNIX

At UMBC there are many UNIX resources for your research or classroom projects. OIT provides Linux and Sun Solaris at gl.umbc.edu – to use this from a Windows PC you will need to install a ssh client on your computer. You can get one of these, free of charge, on the UMBC internet CD. The CD is available at the OIT Helpdesk in Engineering 020. The program on the CD is called “TeraTerm SSH”. Once installed, TeraTerm will allow you to login to the various UNIX machines that you have access to.

Interested students can get detailed, step-by-step directions on using UNIX and its’ commands through an interactive tutorial by visiting <http://www.umbc.edu/oit> and click on “*Unix*” under the “*Hardware and Software*” sub-heading.

Frequently Asked Questions (FAQ's)

Q: I need help with UMBC computing resources, who do I contact?

A: For UMBC related computing questions, you should contact the OIT helpdesk via email at helpdesk@umbc.edu , via phone at 410-455-3600, or in person at Engineering 020.

Q: I've talked to the helpdesk and I still have problems, who do I contact now?

A: Contact our IT support specialist by email at meit@umbc.edu or via phone at 410-455-6350. Also, the IT support specialist has an office in Engineering 229a where walk-ins are always welcome.

Q: I've heard that I can dial in to UMBC for free internet access from home, is this true? How do I do it?

A: If you visit the OIT helpdesk in Engineering 020, you can get the UMBC internet CD. This CD will setup your computer for dial in access, assuming you have a modem and a phone line connected.

Q: I am looking to purchase a PC for personal use, and was wondering who can I contact for help?

A: If you have questions, you can either talk to someone in the UMBC bookstore located in the UMBC Commons, or you can feel free to talk to our IT support specialist.

Q: I have problems with my Mechanical Engineering disk server use or other Mechanical Engineering computer, where do I go for help?

A: Please contact our IT support specialist at 410-455-6350, via email at meit@umbc.edu or in the office Engineering 229a.

Q: When are the ME CAD Lab (Eng 114) and Freshman Engineering Labs (ITE 238) open for use?

A: Typically the ME CAD Lab is on the same schedule as OIT labs. The schedule is printed outside Engineering 020, and outside most labs. The Freshman Engineering Lab is closed on weekends, and is closed at night after 10 as well. To access this lab at certain times, you may also need to be given key card access.

Q: Some of the data in this booklet seem out of date. Where can I find the most up-to-date information?

A: <http://www.umbc.edu/engineering/me/it>

Specialized Engineering Software Catalog

The Department of Mechanical Engineering maintains software packages listed below to support our mission of preparing students to use modern engineering tools and techniques.

<u>Software</u>	<u>Web Site</u>
Fluent	www.fluent.com
CFDRC	www.cfdrc.com
Abaqus	www.hks.com
I-DEAS	www.ugs.com
Pro-E	www.ptc.com
MS Project	www.microsoft.com/project
LabView	www.ni.com
MS Office	www.microsoft.com/office
AutoCAD	www.autocad.com
Matlab	www.matlab.com

SOFTWARE PACKAGE: FLUENT

Faculty contact: Charles Eggleton

Description: FLUENT is a state of the art computer program for modeling fluid flow at Reynolds numbers large than one and heat transfer in complex geometries. FLUENT provides complete mesh flexibility, solving your flow problems with unstructured meshes that can be generated about complex geometries with relative ease and can be imported from other software packages, e.g. ProE. Supported mesh types include 2D triangular/quadrilateral, 3D tetrahedral/hexahedral/pyramid/wedge, and mixed (hybrid) meshes. FLUENT also allows you to refine or coarsen your grid based on the flow solution.

The FLUENT Solver has the following capabilities:

- Flows in 2D or 3D geometries using unstructured meshes
- Incompressible or compressible flows
- inviscid, laminar and turbulent flows
- Newtonian or non-Newtonian flow
- Convective heat transfer, including natural or forced convection
- Coupled conduction/convection heat transfer
- Radiation heat transfer
- Inertial(stationary) or non-inertial (rotating) reference frame models
- Chemical species mixing and reaction, including combustion and surface deposition reaction models
- Arbitrary (user defined) volumetric sources of heat, mass, momentum, turbulence and chemical species
- Flow through porous media

Instructional use: ENME 489F, ENME 645

Website: - *www.fluent.com*

Operating system: Sun Solaris

Location/Host: perigee.engr.umbc.edu

Manuals: hard copies available in E 230 and online

Usage: At the UNIX prompt issue this command: /usr/engr/Fluent.Inc/bin/fluent

SOFTWARE PACKAGE: CFDRC

Faculty contact: Dawn J. Bennett

Description: The Computational Fluid Dynamics Research Corporation Code (CFDRC) offers unique capabilities for Multiphysics, Multiscale, and Coupled Simulations of fluid, thermal, chemical, biological, electrical, and mechanical phenomena for real world applications. The CFDRC software enables solving complex engineering problems and leads to improved concepts, designs, products, and systems.

Some disciplines and topics covered by CFDRC include the following:

- **Fluid Mechanics**
Subsonic to Hypersonic, Compressible, Incompressible, Viscous, Inviscid, Creeping and Turbulent Flows
- **Heat Transfer**
Conduction, Natural/Forced Convection, Conjugate Heat Transfer, and Radiation
- **Chemistry**
Instantaneous/Equilibrium, Multi-step, Finite Rate, and Catalytic Reactions, Deposition and Etch Mechanisms as well as Bioelectrochemistry
- **Fluid Field-Structure Interaction (FSI)**
Mechanical & Thermal Stress, Anisotropic Material Properties, Large/Nonlinear Deformations, Elastic/Rigid Contact Model, and Elastohydrodynamics
- **Electro-Physics**
Electrostatics & Magnetics Plasma, Electrokinetics, Electrochemistry, Optoelectronics, and Device Physics

Instructional use: ENME 813F

Website: *www.cfdrc.com*

Operating system: Microsoft Windows

Location/Host: ME CAD Lab (Engineering 114), Freshman Engineering Lab (ITE 238)

Manuals: installed with software

Usage: In Windows: start program from programs menu in the start menu.

SOFTWARE PACKAGE: ABAQUS**Faculty contact:** Panos Charalambides

Description: ABAQUS is a suite of powerful engineering simulation programs, based on the finite element method, that can solve problems ranging from relatively simple linear analyses to the most challenging nonlinear simulations. ABAQUS contains an extensive library of elements that can model virtually any geometry. It has an equally extensive list of material models that can simulate the behavior of most typical engineering materials including metals, rubber, polymers, composites, reinforced concrete, crushable and resilient foams, and geotechnical materials such as soils and rock. Designed as a general-purpose simulation tool, ABAQUS can be used to study more than just structural (stress/displacement) problems. It can simulate problems in such diverse areas as heat transfer, mass diffusion, thermal management of electrical components (coupled thermal-electrical systems) acoustics, soil mechanics (coupled pre fluid-stress analyses), and piezoelectric analysis.

Instructional use: ENME471, ENME899F**Website:** - www.hks.com/**Operating system:** Microsoft Windows, Red Hat Linux**Location/Host:** ME CAD Lab (Engineering 114), Freshman Engineering Lab (ITE 238), titan.umbc.edu & installed on individual Windows and Linux workstations**Manuals:** Hard copies available in ME Lounge**Usage:** In Windows: start program from programs menu in the start menu. In UNIX: run the “abaqus” command from the location where it is installed.

SOFTWARE PACKAGE: I-DEAS

Faculty contact: Panos G. Charalambides

Description: Integrated Design Engineering Analysis Software (I-DEAS) is a state-of-the-art three dimensional (3D) solid modeling computer program with built-in capabilities for solving a wide variety of engineering problems using the finite element method. I-DEAS is designed with many different "application" modules which incorporate sub-structured "tasks". All of these modules share a common database and I-DEAS allows for the easy sharing of design geometry between different groups. The list of I-DEAS applications includes Design (Solid Modeling), Drafting, Simulation (Finite Element Analysis), Test, Manufacturing, Management, and Geometry Translators. I-DEAS provides tools to mesh two dimensional (2D) and 3D wireframe geometries which could be seamlessly integrated into a detailed finite element model. Additionally, finite element meshes could be exported to other software utilities such as ABAQUS.

The finite element solver in I-DEAS has the following capabilities:

- Linear mechanics problems - basic static and dynamic structural analysis, steady state heat transfer, and flow analysis.
- Non-linear mechanics problems - analysis of non-linearities encountered in design evaluation by simulating large deformation and rotations, and predicting the effects of plastic material deformation, material hardening, and creep.

Instructional use: ENME 471, ENME 815F

Website: - *www.ugs.com*

Operating system: SGI IRIX (64-bit) and Microsoft windows

Location/Host: ME CAD Lab (Engineering 114), Freshman Engineering Lab (ITE 238), titan.umbc.edu & installed on individual Windows workstations

Manuals: Online Documentation

Usage: In Windows: start program from programs menu in the start menu. In UNIX: run the "run_ideas" command. It is located in /usr/local/ideas/bin.

SOFTWARE PACKAGE: ProE

Faculty contact: Anne Spence, Stacey Sullivan

Description: PTC is the market leader in 3D Computer-Aided Design. Pro/ENGINEER is a very powerful parametric 3D-CAD program that details the form, fit, and function of products. Full associativity means that product changes made anywhere update deliverables everywhere. Pro/ENGINEER is fully interoperable across all major CAD data formats.

Product Capabilities

- Completely define the 3D digital product in a single, native, and scalable environment with robust multi-CAD interoperability.
- Automatically capture design intent through sketcher constraints and leveraging full associativity across all functional areas at all depths.
- Basic and Advanced Parametric Surfacing - Change the definition of a feature 'on the fly', instantly changing the same geometry shape from surfaces to solids to cuts
- ModelCHECK™ Model Quality Verification - ModelCHECK analyzes your model, identifies problems in your design, and makes suggestions on how to correct the issues. ModelCHECK has the capability to enforce ISO, corporate and industry standards, and serves as a gatekeeper preventing your PDM system from accepting non-compliant models.
- Assembly Management - Pro/ENGINEER users can easily handle assemblies of any size—even a million parts.
- Mechanism Animation and Kinematics - Test real-world product performance with structural, motion and thermal simulation using Pro/Mechanica
- 2D import wizards give you complete control during the import of AutoCAD and other 2D data into Pro/ENGINEER, so you can easily control layers, fonts and 2D views. IGES, STEP, ACIS and Parasolid files (among others) are also supported, therefore, 3D data from most CAD systems including SolidWorks®, Inventor®, and many more can be imported.

Instructional use: ENES 101, ENME 204

Website: *www.ptc.com, www.prostudent.com*

Operating system: Microsoft Windows

Location/Host: ME CAD Lab (Engineering 114), Freshman Engineering Lab (ITE 238) & installed on individual Windows workstations

Manuals: online documentation

Usage: In Windows: start program from programs menu in the start menu.

SOFTWARE PACKAGE: Microsoft Project

Faculty contact: Awad Gharib

Description: Ms-Project provides the core tools that project managers, business managers, and planners need to manage schedules and resources independently. With MS-Project, you can efficiently organize and track tasks and resources to keep your projects on time and within budget. Smooth integration between MS-Project and other Microsoft Office System programs like Microsoft Office PowerPoint® and Microsoft Office Visio® 2003 enables you to present project status effectively. Extensive help resources and printing assistance make MS-Project easier than ever to learn, so you can be productive quickly.

Student tutorials:

<http://www.lf.psu.edu/lf/msproject/contents.htm>

<http://office.microsoft.com/en-us/training/CR061832711033.aspx>

Instructional use: ENME 204, or any other class that has a final project

Website: *www.microsoft.com/project*

Operating system: Microsoft Windows

Location/Host: ME CAD Lab (Engineering 114), Freshman Engineering Lab (ITE 238)

Manuals: Online Documentation

Usage: In Windows: start program from programs menu in the start menu.

SOFTWARE PACKAGE: LabView

Faculty contact: Marc Zupan

Description: LabVIEW delivers a powerful graphical development environment for signal acquisition, measurement analysis, and data presentation. LabVIEW is an open environment designed to make interfacing with any measurement hardware simple. With interactive assistants, code generation, and connectivity to thousands of devices, LabVIEW makes gathering data as simple as possible. With LabVIEW, you can quickly acquire and generate signals from plug-in boards, USB devices, and Ethernet-based systems. These I/O capabilities, combined with special data types and measurement analysis VIs, are specifically designed to get the measurement you need from your physical sensors.

You can perform a wide variety of measurements with LabVIEW:

- Temperature, Voltage, Resistance, Pressure, Strain
- Current, Pulse, Force, Vibration, Frequency, Period
- Sound, Light, Digital Signals and much more

LabVIEW has more than 450 built-in functions designed specifically for extracting useful information from any set of acquired data and for analyzing measurements and processing signals. LabVIEW includes a variety of measurement analysis tools, such as curve fitting, signal generation, peak detection, and probability and statistics. Measurement analysis functions can determine signal characteristics such as DC/RMS levels, total harmonic distortion (THD/SINAD), impulse response, frequency response, and cross-power spectrum. Using LabVIEW, you can employ numerical tools for solving differential equations, optimization, root finding, and other mathematical problems.

Instructional use: ENME432L, ENME482L

Website: - *www.ni.com*

Operating system: Windows, Mac, SOLARIS, UNIX, Linux, Palm OS

Location/Host: installed on individual Windows Computers

Manuals: All manuals and equipment documentation are available in PDF from the website. Hard copies available in E 229.

Usage: In Windows: start program from programs menu in the start menu.

SOFTWARE PACKAGE: Microsoft Office

Staff contact: Tim Champ

Description: Microsoft Office consists of Word, Excel, Power Point, Publisher, Outlook, Access and Frontpage. In Mechanical Engineering, the most commonly used are Word and Power Point.

Word is used for word processing. Examples would be writing a proposal, a paper for class or a research report.

Power Point is often used to make presentations. Due to its multimedia abilities, your presentation can do many things that overheads and paper handouts cannot. Embedded movies, sound and other effects are just a few things that it can do.

Basic usage of these programs is easy. You start them up and they are ready to run. Most menu's are very well defined, and if you have any questions, you can always start the help function.

Instructional use: Most UMBC Classes

Website: *<http://www.microsoft.com/office>*

Operating system: Microsoft Windows & Mac OS X

Location/Host: ME CAD Lab (Engineering 114), Freshman Engineering Lab (ITE 238) & installed on individual Windows computers

Manuals: Online help is included with an Office install. More help is available at the website for the software.

Usage: In Windows: start program from programs menu in the start menu.

SOFTWARE PACKAGE: AutoCAD

Faculty contact: Anne Spence

Description: AutoCAD® software is a worldwide standard in computer-aided design (CAD). More people use AutoCAD than any other CAD software. With AutoCAD® 2005 you can efficiently create single drawings and deliver a coordinated set of drawings in a timely manner. New tools like the table object and tool palettes boost productivity, and the new Sheet Set Manager helps you control content across entire sets of related drawings, reducing the risk for errors.

Instructional use: ENES101

Website: *www.autocad.com*

Location/Host: ME CAD Lab (Engineering 114), Freshman Engineering Lab (ITE 238)
& installed on individual Windows workstations

Operating system: Microsoft Windows

Manuals: Online Documentation (Installed with software)

Usage: In Windows: start program from programs menu in the start menu.

SOFTWARE PACKAGE: MATLAB

Faculty contact: Bill Wood

Description: Matlab is a general-purpose engineering programming and simulation environment. It is based on powerful linear algebra routines for doing fast matrix computation, but also provides a generic programming language and interpreted development environment to allow fast development of engineering analysis applications. It also offers powerful plotting and visualization. SIMULINK provides a block diagram interface for energetic systems design and simulation.

In addition to the core programming functionality, MATLAB includes toolboxes for:

- Communications
- Controls
- System Identification
- Image processing
- Mapping
- Neural Networks
- Optimization
- Neural network controls
- Partial differential equations
- Robust control
- Signal processing
- Statistics
- Symbolic math
- Wavelets

Instructional use: ENME 303, ENME 403, ENME 610

Website: - www.matlab.com

Location/Host: ME CAD Lab (Engineering 114), Freshman Engineering Lab (ITE 238), Any OIT lab machine, installed on individual Windows & Linux Workstations (on-campus only), coe-sun1.engr.umbc.edu & titan.umbc.edu. An older version can be installed for home use.

Operating system: Unix, Linux & Windows

Manuals: Type 'help' in command window, soft and online manuals and tutorials

Usage: In Windows: start program from programs menu in the start menu. In Unix, type `/usr/local/bin/matlab`

