

Center of Innovation in Mechanics for Design and Manufacturing TEXAS A&M ENGINEERING EXPERIMENT STATION



A Three-Day Short Course on WRITING A VUMAT FOR ABAQUS

16-18 December 2020

https://cimdm.tamu.edu/events/shortcourse-abaqus-vumat

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ABOUT THE COURSE

In this three-day course, the important aspects of writing Abaqus VUMATs for simple materials such as elastic and elastic-plastic materials will be covered. By completing the course, participants will gain knowledge on the basic structure of a VUMAT and how to write a VUMAT for different class of materials.

Prerequisites/software requirements: (a) Basic knowledge of programing language (FORTRAN, C, etc.). FORTRAN will be used, for this course. (b) TAMU HPRC account to run Abaqus and FORTRAN compiler. (c) AnyConnect VPN client software. (d) MobaXterm software for running simulations.

(b) Steps for getting HPRC account: Please refer to the subsequent pages.

(c) Steps for downloading & installing VPN software: <u>https://servicenow.tamu.edu/tamu-</u> <u>selfservice/knowledge_detail.do?sysparm_document_key=kb_knowledge,KB0010670%20v11.0</u> <u>&sysparm_searchtable=kb_knowledge</u>

(d) Steps for downloading & installing MobaXterm (for a Windows system): Please refer to the subsequent pages.

If you are following the tutorial from outside TAMU, please connect to the VPN client before opening the MobaXterm software. If you are attending this tutorial from within TAMU, you do not require a VPN but you only require the MobaXterm software.

Medium of instruction: Zoom (the Zoom link will be posted on the <u>CiMDM</u> website a few days before the course).



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TENTATIVE SCHEDULE

Day 1: 16 Dec (11am to 1230pm)

- (1) *Brief aspects of an Abaqus input deck structure:* We will model a simple homogeneous deformation problem (simple tension/compression, simple shear, plane strain tension/compression), generate results and contour plots.
- (2) *Structure of VUMAT*: component ordering convention in Abaqus, unmodifiable variables, modifiable variables. VUMAT structure, material constant arrays, state variable arrays.

Day 2: 17 Dec (10am to 1130am)

- (1) Writing a VUMAT for an elastic-plastic material: Description of constitutive equations, programing the constitutive relations into a time-integration procedure, running Abaqus simulations for the aforementioned homogeneous deformation problems listed above.
- (2) *VUMAT for elastic materials*: Reduction of elastic-plastic model to purely elastic response, performing Abaqus simulations for the homogeneous deformation problems from Day 1.

Day 3: 18 Dec (10am to 1130am)

In-class exercise: A brief description and relevant VUMAT modification for elastic-plastically-hardening material response.



Steps to Apply for a TAMU High Performance Research Computing (HPRC) Account

Step 1. Access to the below webpage to apply computing account on TAMU HPRC webpage: <u>https://hprc.tamu.edu/apply/</u>

Step 2. At the webpage, check the information that you need to apply the account. You need to have the information in the red box.



Step 3. Click 'Login' button to initiate the application process.

Step 4. Use your NETID to login.

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	Current Users
	NetID or Email Address
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1	Next Forgot your password?
	New Student or Employee? Activate your NetID



Step 5. Confirm your academic classification and click 'Next'.

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Academic Classification	1	
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Step 6. Click 'New Basic' to apply new account.

Apply with a New Application	
Please choose one of the following to apply for an account.	
For more information about account allocations, please consult our $\underline{\theta}$	our Account Allocation Poli
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Step 7. Please read the instructions carefully and fill out the information that you prepared. After finishing the account applying process, you will get an email from 'help@hprc.tamu.edu' about the result of the account application.





Installing and using MobaXterm at Windows computer

1. Download the MobaXerm software at the website. Download the Home



2. After installing the MobaXterm, if you run the software, then the below window will appear. Click 'Session' icon at the top left corner (in the red box).





3. At the pop up window, click the 'SSH' icon at the top left corner. Then the below window will show up. Please fill out the Remote host * as 'terra.tamu.edu' or 'ada.tamu.edu' and Specify username with your NETID. Then click 'OK' icon at the bottom of the window.

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4. The MobaXterm will show you the below page if MobaXterm remembers your login password. If this is your first access, then you need to type in your login password. By using the Duo push, you could finish the login.





5. After login, you will see the below page. Please change the directory to the scratch folder. This folder has more space to store the data files. Please type below command line.

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6. Also, you could change the search tree directory by typing the address. Below image shows the example of changing the directory to the scratch folder of username 'kghfk'.



7. After making your own directory folder in scratch folder, you could drag and drop your files for the analysis.