

**Take Home Exam 2**  
**40 points out of 100 points of Exam 2 Score**

Due: Monday, December 20, 11:59 PM (no late submission will be accepted)

For this take-home exam you'll have to use your `simEngine2D` to determine the time evolution of the slider-crank mechanism in section 8.2 of the textbook (pp. 283). Specifically, you'll work with the mechanism in Fig. 8.2.3. The dynamics analysis setup is described in subsection 8.2.4. Please note that you'll have to make sure that the gravity acts as indicated in the problem. For this problem the concentrated point-force  $F_c$  has a rather complicated expression that depends both on the position and velocity states of the system. You will have to use a separate MATLAB routine to implement this concentrated force term. To this end, define in your `amd` file a force with `Id=1` that assumes a constant value, say 10, but when you actually work with this force with `Id=1` you'll have to invoke your specialized MATLAB routine to compute the expression of the force.

- a) Generate two files, *slidercrank.acf* and *slidercrank.adm* that you use in modeling the mechanism and setting up the dynamics analysis. For this simulation,  $T_{end} = 1$ , and the step-size  $\Delta t = 0.005$ . All units are SI.
- b) Run the required analyses to generate the plots 8.2.5 through 8.2.8 (pp. 288).

HINT: you might debug the code more easily if you constrain the motion of body 3 using an angle absolute constraint  $\phi_3 = 0$  and a  $y_3 = 0$  absolute constraint. Post any questions that you might have on the forum.

NOTE: the outcome of the simulation using `simEngine2D` should be a file called *slidercrank.res*, which, based on information specified in the `acf` file, stores position, velocity and acceleration information at each time step of the simulation for each body of interest.

What you should turn in:

- In one zipped file, "takeHomeExamYourFirstName.zip", turn in *\*all\** the MATLAB files necessary to run your `simEngine2D`. Make sure that there is a file called `simEngine2D.m` which can be called from the MATLAB command line and generates the *slidercrank.res*. This directory should also include the files *slidercrank.acf* and *slidercrank.adm* that you used to generate *slidercrank.res*.
- Include in your directory the plots (in `png` format or similar) that are supposed to look like plots 8.2.5 through 8.2.8 in the textbook.

Keep all your files in a directory `takeHomeExamYourFirstName`. It is this directory that you should zip and email the grader ([jcmadsen@wisc.edu](mailto:jcmadsen@wisc.edu)). The grader will unzip the file, start MATLAB from the directory `takeHomeExamYourFirstName`, and type

```
>> simEngine2D('slidercrank')
```

The TA will not debug your code if when issuing this command he does not get the results file *slidercrank.res*. Email the TA or come to talk to me during office hours for MATLAB related questions.