

End of the Semester

# Student Feedback

**Dynamics and Vibrations, MAE 4735 and 5735**  
**Professor Andy Ruina**  
**Fall 2012**

44 students took this combined course.

We have feedback from 9 of 10 students in MAE 4735 .

We have feedback from 31 of 34 students in MAE 5735

(24 through official channels and 7 through anonymous email sent to the TA and forwarded without names to the Professor).

That is, we have feedback from 90% of the students who took this course this fall.

These are all in this pdf, in 3 parts:

1) 5735 survey (24 students)

2) 4735 survey (9 students)

3) Additional comments sent to TA anonymously (all 7, but maybe one, from 5735 students).

**College of Engineering, Cornell University**  
**Course Evaluation Response Summary**  
**Semester: Fall 2012**      **Course Owner: MAE**  
**Course: MAE 5735**      **CID: 17190**  
**Instructor: Ruina**  
**24 Responses, 34 Enrolled, 70.59% Response**

<b>Question</b>	<b>Mean</b>	<b>Count</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
1. How valuable were the assigned readings? 1=taught me little; 5=extremely educational	3.33	15	1	3	4	4	3
2. How valuable were the homework and/or computer assignments? 1=taught me little; 5=extremely educational	4.24	21	0	1	2	9	9
3. How valuable were the laboratories? 1=taught me little; 5=extremely educational	4.33	3	0	0	1	0	2
4. Rate the examinations in this course as a test of your knowledge. 1=too easy, not adequate; 3=adequate; 5=too difficult, not a fair test	3.81	21	0	0	7	11	3
5. Did the lecturer stimulate your interest in the subject? 1=not at all; 5=stimulated great interest, inspired independent effort	4.14	22	0	2	3	7	10
6. Was the lecture presentation organized and clear? 1=disorganized and unclear; 5=very organized and lucid	4.05	22	0	1	5	8	8
7. Was the lecturer willing and able to help you overcome difficulties? 1=was of no help; 5=was very helpful	4.36	22	0	0	5	4	13
8. Rate the overall teaching effectiveness of your lecturer compared to others at Cornell. 1=worse than average; 5=much better than average	4.05	22	0	1	7	4	10
9. Was the recitation organized and clear? 1=not at all; 5=very organized, lucid	4.40	5	0	0	1	1	3
10. Was the recitation instructor willing and available to help you overcome difficulties? 1=was of no help; 5=was very helpful	4.22	9	0	0	2	3	4
11. How would you rate the recitation instructor's command of the course material? 1=poor command of material; 5=excellent command of material	4.25	8	0	0	1	4	3
12. What was the overall quality of the recitations and your recitation instructor? 1=worse than average; 5=much better than average	4.25	4	0	0	1	1	2
13. Overall, how does course compare with other technical courses you've taken at Cornell? 1=poorly, not educational; 5=excellently, extremely educational	4.05	20	0	1	6	4	9
14. How many hours each week did you spend on this course outside of class/lab/recitation? 1=less than 2; 2=(2-4); 3=(5-8); 4=(9-15); 5=16 or more	3.68	22	1	1	7	8	5
15. How prepared were you for this course? 1=overprepared, it repeated material; 5=underprepared, course assumed unfamiliar knowledge	3.14	22	0	4	12	5	1
16. Was the code of academic integrity maintained in this course? 1=no, often violated; 5=yes, well maintained	4.90	21	0	0	1	0	20
17. Most important reason for taking this course? 1=field or major requires it; 2=prerequisite for further courses of interest; 3=interest in subject matter; 4=reputation of the course; 5=reputation of the instructor	--	22	7	1	12	0	2

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**1. Please comment on the strengths of any aspect of this course (e.g., the lecture, recitation, laboratory, computing, text, homeworks, examinations or course content).**

90908: lectures are really perfect

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91233: The homeworks are very educational and there are a lot of concepts that you can learn from them. Exams were fair and good test of course material. The lectures were very adaptable in terms of pace and contents (at times).

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92886: Lecture

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93591: I liked:  
1) Prof. Ruina's approach to teaching intuition,  
2) how the homeworks had us apply the theory in MATLAB.

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95566: -----  
K K  
12/1/12  
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Prof. Ruina paid a huge amount of attention to pedagogy. He has a knack for distilling complicated material down to its simplest essence. He also used lots of little, helpful tricks like:

- Writing a clear lecture outline on the blackboard before each class
- Encouraging participation by asking interesting questions and welcoming responses (even totally wrong ones)
- Involving awesome demonstrations, either physical or on the computer
- Making explicit connections between the material and other courses/research/disciplines

etc.

Prof. Ruina also went way above and beyond what was required of him in terms of being available outside of class. His office hours were extremely helpful, as were his extra problem solving sessions.

Overall grade: A+

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96563: The professor was able to incorporate feedback throughout the semester to improve the quality of the course

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96978: lectures

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96995: The examples in the lecture and the homework problems were very helpful in understanding the applications of things that have been gone over in the lectures.

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96996: Homeworks really helped to better my understanding in the subject matter. Office hrs with professor ruina were also a huge help to me

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97299: I thought the homework, while long, really helped me learn the material.

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97457: The lectures were well prepared, interesting and engaging.

The in class MATLAB was very helpful, but would have been more helpful if it happened in a computer lab where we could follow along and code concurrently.

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98195: Gained a strong understanding of angular momentum balance which I had been lacking from undergrad.

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98352: The MATLAB demonstrations were very useful. Office hours were very helpful, and often made me think about the material beyond the assignment discussed.

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98439: The prelim and homework regrade system were fair and helpful for learning material

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98807: Good, genuine teaching style stimulates interest from the solutions and real world thinking, problem solving and application was abundant.

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98882: Encouraged "mastery of subject"

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99550: I realized that I didn't really know dynamics as well as I thought I did. There were huge holes in my knowledge, especially angular momentum balance, which I now realized I thought of in terms of high-schoolish and freshman level physics. Ruina was able to give a 'crash course' which was also in-depth, and I feel I developed rigor and intuition I wouldn't have otherwise.

I don't think I would have fully understood what was required of me on the qualifying exam, or been equipped to approach them correctly, without Ruina explicitly guiding me towards and through these problems.

The course/class objectives were always well-defined; I knew where we were, where we were going, and why we were doing each specific topic we did at all times.

He wasn't an expert on vibrations, but did the best he could anyway. I liked the fact that he didn't use his (relative) inexperience as a crutch, nor was overconfident or over-assertive in what he was saying.

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**2. Please comment on the weaknesses of any aspect of this course (e.g., the lecture, recitation, laboratory, computing, text, homeworks, examinations or course content).**

91233: None

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92886: Homework sometimes long

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93591: There shouldn't be any homework due on finals week.

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95566: The one downside to this course is what I'll call this a "Students' Rights" issue (no laughing).

Cornell policy makes the following suggestions:

1) Students should expect to spend 3 hours outside of class, per credit hour, per week.

Source: <http://www.engineering.cornell.edu/academics/undergraduate/assistance/peer/guide/choosing.cfm>

2) Breaks are breaks. Professors are discouraged from assigning work on fall break, Thanksgiving break, during study week, etc.

Source: <http://www.news.cornell.edu/stories/March11/FacEaseBreaks.html>

Discussion of #1: early on in the semester I genuinely tried to complete every homework question, every week. Some weeks, that meant spending 25+ hours on this 3 credit class -- 3 times the recommended amount. Later on I realized that it was okay to truncate my solutions in order to confine them to a reasonable amount of time. That helped.

Discussion of #2: Pretty much self-explanatory. Yes, we're all here to learn, yes we really really appreciate having wonderful professors who want to train us to be science ninjas, but we grad students also spend a lot of hours hunched over books and desks and keyboards. Sometimes we need a few days to recuperate.

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96563: I feel like this course focused too much on numeric solutions and did not spend enough time on the theory / where the equations actually come from.

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96978: homeworks

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96995: The organization of the course was slightly weak; the course didn't have a clear syllabus that was set before and the way the HW problems were assigned (added to the end of syllabus instead of having a clear presentation) was confusing at first.

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96996: Homeworks were a bit long and strenuous at times

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97299: I thought the lectures were sometimes repetitive.

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97457: I thought having a final project as well as a final exam was a bit much. Having clearer intermediate goals for the project would have been very helpful.

It would also be helpful to have more structured student collaboration, to have a broader view of how to do the MATLAB portions.

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98195: The lectures sometimes seemed wonder about different topics rather than having a set plan. The matlab homework was a bit repetitive. The vibrations portion was lacking, I blame this less on the professor and more on him having to combine 2 courses. The final project was not very enlightening, we had solved a double pendulum and a 4

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bar link already. It was time consuming however, but that was due to debugging matlab code.

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98352: A more concise dynamics text would have been a great addition.

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98439: Homework's heavily based on matlab

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98807: Theory was review and did not need covered and computer formulation was new covered too quickly. Rather than try to teach a class kind of about the physics of mechanics and kind of about solving equations and making models with computers, using Matlab and programming, it would be great to have a course about each. This course did a poor job of trying to address two topics, and it would be better to choose 1 topic to address well, or have a course for each. Personally, I find the foundations of numerically solving mechanics problems, and programming solutions on computers to be the more beneficial topic.

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98882: As it was a new class, the goals/subject matter were still being decided on

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99550: The volume of work was really too much for me at times. I felt as if the same level of understanding could have been reached without doing twenty hours of homework a week for this class, which is about what I felt I had to do in order to do a good job.

I got the impression that Ruina 'didn't like' solving certain problems in certain ways. Though I realize that he's allowed to direct the class the way he wants, I wasn't a fan of how he discouraged the use of Lagrange's equations- I'd prefer an 'equal opportunity' lecture series.

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**Extra Question # 1 :**

**MAE has attempted to get student feedback in all courses at the mid semester time frame, in an effort to improve the course delivery. Please comment on any improvements in this course since mid-semester.**

91233: None

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92886: better homework on theories

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93591: Course maintained its high quality.

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95566: I thought the course was top notch from day one. It's hard to improve upon success.

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96563: The professor made the homework less about MATLAB and more about setting up the simulation.

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96978: not much

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96996: Extra Problem sessions at latter half of he course really helped

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97299: I have not noticed much change in this course since mid-semester.

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98352: Student participation has been encouraged more often.

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98882: In my opinion, dynamics is dynamics and vibration analysis is vibration analysis -- they are 2 different disciplines and should not be lumped into one class

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99550: We made an effort to re-examine material that was thought basic and prerequisite but not actually known as well as Ruina would have liked, which helped me.

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**Course: MAE 4735 Lec 1**      **CID: 17188**  
**Instructor: Ruina**  
**9 Responses, 10 Enrolled, 90.00% Response**

Question	Mean	Count	1	2	3	4	5
1. How valuable were the assigned readings? 1=taught me little; 5=extremely educational	3.00	2	0	0	2	0	0
2. How valuable were the homework and/or computer assignments? 1=taught me little; 5=extremely educational	4.11	9	1	0	0	4	4
3. How valuable were the laboratories? 1=taught me little; 5=extremely educational	--	0	0	0	0	0	0
4. Rate the examinations in this course as a test of your knowledge. 1=too easy, not adequate; 3=adequate; 5=too difficult, not a fair test	3.44	9	0	0	6	2	1
5. Did the lecturer stimulate your interest in the subject? 1=not at all; 5=stimulated great interest, inspired independent effort	4.00	9	0	0	1	7	1
6. Was the lecture presentation organized and clear? 1=disorganized and unclear; 5=very organized and lucid	4.00	9	0	2	0	3	4
7. Was the lecturer willing and able to help you overcome difficulties? 1=was of no help; 5=was very helpful	4.78	9	0	0	0	2	7
8. Rate the overall teaching effectiveness of your lecturer compared to others at Cornell. 1=worse than average; 5=much better than average	4.67	9	0	0	0	3	6
9. Was the recitation organized and clear? 1=not at all; 5=very organized, lucid	--	0	0	0	0	0	0
10. Was the recitation instructor willing and available to help you overcome difficulties? 1=was of no help; 5=was very helpful	--	0	0	0	0	0	0
11. How would you rate the recitation instructor's command of the course material? 1=poor command of material; 5=excellent command of material	--	0	0	0	0	0	0
12. What was the overall quality of the recitations and your recitation instructor? 1=worse than average; 5=much better than average	--	0	0	0	0	0	0
13. Overall, how does course compare with other technical courses you've taken at Cornell? 1=poorly, not educational; 5=excellently, extremely educational	3.88	8	0	1	0	6	1
14. How many hours each week did you spend on this course outside of class/lab/recitation? 1=less than 2; 2=(2-4); 3=(5-8); 4=(9-15); 5=16 or more	3.13	8	1	1	3	2	1
15. How prepared were you for this course? 1=overprepared, it repeated material; 5=underprepared, course assumed unfamiliar knowledge	3.25	8	0	1	5	1	1
16. Was the code of academic integrity maintained in this course? 1=no, often violated; 5=yes, well maintained	4.75	8	0	0	0	2	6
17. Most important reason for taking this course? 1=field or major requires it; 2=prerequisite for further courses of interest; 3=interest in subject matter; 4=reputation of the course; 5=reputation of the instructor	--	9	1	0	6	0	2



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**1. Please comment on the strengths of any aspect of this course (e.g., the lecture, recitation, laboratory, computing, text, homeworks, examinations or course content).**

95925: The course was good, well taught. The homeworks were good practice, the tests were fair.

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96892: Lecture was always very clear and Professor Ruina was always very helpful in office hours. I definitely preferred the dynamics portion of the course.

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96985: Aims to a strong theoretical understanding of the material. Professor Ruina is very enthusiastic about helping students understand his method of thinking about the subject.

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97300: Taught us interesting and useful material.

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97836: Prof. Ruina was a very effective lecturer. I did like how he emphasized learning over grades by doing things like allowing for homework/exam redos.

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98579: Exams were very good

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**2. Please comment on the weaknesses of any aspect of this course (e.g., the lecture, recitation, laboratory, computing, text, homeworks, examinations or course content).**

95925: The homeworks often took a really long time. I don't feel like vibrations was emphasized much by this course, it was really more about dynamics and then a little bit on vibrations. The vibrations textbook and I did not get along.

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96892: Perhaps try to assign homeworks on time and don't change them or their due dates after that time. It's confusing and very inconvenient when you find you have more homework than you planned for.

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96985: The material can feel repetitive at times. Additionally the homework was often discouraging, taking several hours with no way to check solutions.

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97300: Homeworks were time consuming.

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97836: It is pretty clear this class was more or less a trial-by-fire for Prof. Ruina. This was most evident when we got to the vibrations part of the course. We only touched on a very small part on what the textbook had to offer, and what we did cover did not feel very organized.

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98579: Lectures were at times meandering and hard to follow

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**Extra Question # 1 :**

**MAE has attempted to get student feedback in all courses at the mid semester time frame, in an effort to improve the course delivery. Please comment on any improvements in this course since mid-semester.**

95925: unchanged

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97300: N/A

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## Responses from students who gave feedback to TA rather than through the online course evaluation.

### Student 1

What things do you suggest be kept the same when it is next taught?

- The emphasis on numerical approaches made this a more practical course than other similar courses I've taken, while the lectures still gave a solid analytical foundation.
- The approach to exams, ie trying to make them not time-limited (although that didn't work too well for the final), was nice, it allows the possibility of actually learning from the test.
- The final project was very interesting.

What changes do you suggest for this course when it is next taught? *Especially, how could it change to better serve a student like you? (please don't be too brief here)*

- There should be more basic mechanics problems assigned towards the beginning of the course, with emphasis on using the higher level approach of the class.
- The posting of homework problems, or at least marking out when they were due, became increasingly inconsistent as the semester went on, making it difficult to keep track of. There's definitely a more straightforward system.

### Student 2

Level in school: 1st semester Masters, hopefully switching over to Ph D next semester

#### Things to kept the same:

- Allow students to not do certain problems if they deem them too easy.
- Keep simulations as part of the homework
- Quiz question in class to work with other students on
- Give lots of time on tests

**Things to change:** Especially, how could it change to better serve a student like you? (please don't be too brief here)

- When teaching a topic, teach the entire general approach to the problem, then cover the specific cases where it does not work. For example, when the general  $Mx''+Kx = 0$  matrix was being taught, half the class was used to explain certain cases where the solution may not be  $A\cos + B\sin$ , but  $A + Bt$ . This was taught as an aside in the vibrations course that I previously took, because you rarely run into it, except

maybe on test problems.

- Perhaps teach the Ritz and Rayleigh-Ritz methods.
- Perhaps teach the method Professor Rand taught for  $M\ddot{x} + kx = 0$ , where you assume a solution, get a matrix, and take the determinant equal to 0.
- Perhaps be a bit more thorough with chaos

### **Student 3**

Your level in school?  
1st semester MEng

#### **What things do you suggest be kept the same when it is next taught?**

The focus on different methods for deriving equations of motion for many DOF systems and their pros and cons was helpful (choosing coordinates, lagrange vs. AMB, etc.).

The focus on numerical methods and their associated error sources was especially helpful (Euler integration, exact solutions to vibration problems using eigenvalues, modal coordinates, etc.).

Prof. Ruina was good at being accommodating/responsive to students' needs and interests both in terms of logistics and course material. This is something I often find lacking in the engineering college. This semester, I was glad to have a class with a professor who genuinely cares about his students' learning.

#### **What changes do you suggest for this course when it is next taught?**

I would have been interested in learning about different integration schemes for application outside of MATALB (i.e. beyond Euler and proprietary toolboxes).

The prelims were a good length. The content was pretty representative overall. However, the final was a bit long and I felt the focus fell too heavily on deriving equations of motion and left out other aspects of the course.

On an organizational note:

The numbering system for homeworks was a bit confusing at times. It wasn't always clear (or written at all) which homeworks were due when and there was sometimes conflicting information between the syllabus and what was posted directly on the website.

The course website worked OK overall. I am inclined to prefer Blackboard, though, despite its problems, if only because it automatically sends an email copy of any announcements that are posted.

Especially, how could it change to better serve a student like you?

I took this class hoping for more in-depth material on vibrations. The course was overall a little broad in topics and more theoretical than I was hoping. The focus seemed to be on the theory behind solving idealized dynamics problems. As an MEng student, I am more interested in modeling real systems. For example: structural damping, friction, modeling vibrations of continuous/rigid structures, vibration absorbers. I felt the systems we investigated in the vibrations portion of the course were a bit too conceptual or idealized.

## **Student 4**

Your level in school? (e.g, 4th yr undergrad, 1st year M-Eng, 1st yr PhD, etc).

- 1st year M.Eng in MAE

### **What things do you suggest be kept the same when it is next taught?**

- Emphasis on the angular momentum balance method and showing that it can solve non-trivial problems.
- Emphasis on MatLab application. I've learned a lot about the program throughout this course.
- Some of the more complicated topics in vibration problems such as:
  - Truss application (2D case with one spring)
  - Multi DoF with damping and how it ties up with generalized coordinate system
  - String vibration, especially the derivation of "guessing" gives giving a reasonable frequency for the mode.

### **What changes do you suggest for this course when it is next taught?**

- I tried to get by by using some of the simple reasoning that I've had since high school, and when they started to fail, I was slow to adjust. Some of the easier problems can have lesser emphasis.
- Related to above, harder and more generalized questions can be more intriguing, and can convince students to adopt AMB.
- Some of the harder concepts in vibrations didn't receive the time that they deserve, compared to some of the simpler ones (1DoF with damping and so forth). That being said, things such as the truss example, as well as the string example can be cool. I was somewhat disappointed that they didn't even appear in the exams.

## **Student 5**

Your level in school? (e.g, 4th yr undergrad, 1st year M-Eng, 1st yr PhD, etc).

-1st year M-Eng

### ***What things do you suggest be kept the same when it is next taught?***

-The subject matter for dynamics was excellent. Overall a very thorough look into the subject along with good practice problems.

### ***What changes do you suggest for this course when it is next taught?***

-The biggest thing that I would change would be the method of assigning homework. Although I understand that it is easier for the professor to have a single document that they produce beforehand, it can be extremely confusing for students if they do not check the website/syllabus every day. This has led to a few slip ups on my part, causing a late/missed homework here and there.

-The second thing I would do would be to provide example problems for prelims. Understandably they don't have to be practice exams, but if additional practice problems beyond those assigned for homework were available, that would be good additional practice.

-Greater textbook integration! Although we were assigned a textbook to purchase, it seemed like we hardly made use of it, even though it seems like a very thorough covering of the vibrations course work. I would recommend either assigning some problems out of the book, or referencing examples in the text to clarify concepts and the like. Additionally, if concepts and examples could be pointed to in the Ruina textbook, that would be a big help as well.

## **Student 6**

Your level in school? (e.g, 4th yr undergrad, 1st year M-Eng, 1st yr PhD, etc).

1st year M.Eng

### ***What things do you suggest be kept the same when it is next taught?***

The dynamics section was well taught. I like having examples to think through rather than a teacher solely writing down equations.

### ***What changes do you suggest for this course when it is next taught?***

The vibrations part of the class needs work but that probably isn't a surprise since this was the first time it was being taught by Ruina. Some lectures seemed to repeat more or less the exact thing that was said

in the previous lecture. Something that also should be considered is not giving homework assignments the same week as prelims. It's small but it's always annoying when teachers don't do that, and it takes away from either the student's preparedness for the exam or the quality of the homework assignment. Lastly, it would be nice to provide worked out examples in class so that there is something to work off for the homeworks.

## **Student 7**

**My level in school:** 1st year PhD in applied mathematics

### **What things do I suggest be kept the same:**

I really enjoyed the emphasis on numerical work, especially since it was completely new for me and very relevant to my field. In particular, I liked the homework problem on Montgomery's 8, as it showed the scale of perturbations necessary for the system to become chaotic. I also liked the sled problem, as it presented an example of a simple yet useful mathematical model for a real physical object.

### **What changes do I suggest for this course:**

The one complaint I had about this course was a lack of emphasis on Lagrangian dynamics. To be fair, I realize that the emphasis of the course is on concrete mathematics, and thus balance of linear and angular momentum are the primary tools, but I would have liked to see the Lagrangian get a larger role, as its very purpose is to get around constraint forces to find the equations of motion, and it is relevant to my field of study.

I hope this feedback is useful. Overall, I have found the course to be of tremendous interest and insight and am very glad I took it.