Faculty Development Plan and Proposed Development Projects



Overview

This document constitutes my Faculty Development Plan as described in section 3.1.2 of the "University Policy on Rank and Status."

1. SCHOLARSHIP

1.1 Self-Assessment

1.1.1 Areas of Interest

- Nonlinear dynamics of systems and structures ranging from aerospace vehicles to biological tissues.
 - I am specifically interested in experimental methods to characterize nonlinear systems, reduced-order modeling strategies that provide insight into the key features needed to describe physical behavior and numerical modeling with e.g. finite element analysis.
- Vibration durability test methods including multi-input-multi-output control to replicate vibration environments and methods for assuring that stresses and failures are well replicated between the field (e.g. the flight environment) and the test.
- Substructuring methods and their uses to capture the linear and nonlinear behavior of systems and structures by describing each subcomponent with a minimal model.

1.1.2 Strengths, Skills, and Competencies

- I have a good ability to see and explain the potential impact of research and to use that to help motivate students to learn and to engage in research.
- I have a strength for identifying interesting research projects in my field, especially those that have the potential to impact industrial practice in the near to medium term.
- I have a robust network of national and international collaborators at universities, research labs and industry.
- I'm good at showing my students that I care about them and their future happiness and success and at including students from diverse backgrounds.

1.1.3 Areas for Improvement or Growth

- I struggle to deal effectively with students who are not self-motivated or who are struggling to put in an appropriate amount of effort for research work.
- I tend to tackle research in traditional areas and might be able to increase my research funding and potential for impact by venturing into more exotic research areas.

1.2 Scholarship Goals

1.2.1 Goals to Complete by Dec. 31, 2021 (Fall Semester 2021)

- Transition research with the Kansas City National Security Campus (KC-NSC) and Sandia Labs to my research group at BYU by,
 - o obtaining at least one grant per year from each
 - hiring students who will be respected and sought after for employment by these and other organizations
- Complete work on Engineering Dynamics text book with Ginsberg & Voglewede.

Other Short-term plans (1-4 years)

- Write a review paper on dynamic environment testing and the associated methods.
- Present the first ever comparisons between measurements of vibrations from a structure with nonlinearity due to micro-slip in a bolted joint and finite element models with sufficient resolution to be predictive.
- Continue to have a strong presence (myself and students) at the International Modal Analysis Conference and other related international conferences (i.e. ISMA, NNM, etc...) by bringing high quality papers and completing my term as IMAC Advisory Board Chair.
- Continue to publish high quality journal papers at rate that maintains quality and as quickly as possible so the impact of our work is maximized.
- Obtain funding from AFOSR by developing a proposal that wins the support of colleagues at the Air Force Research Laboratory.

1.2.2 Long-term plans (5-8 years)

- Establish a lab with 3-5 graduate students and an appropriate number of undergraduates by securing sufficient funding and pipelines/practices for recruiting.
 - o This will require approximately \$210-400k/year in research funding
- Work with collaborators in industry, national labs and at other universities to establish quasistatic modal analysis (by Lacayo, 2018) as a standard method for predicting the nonlinear response of various structures.
 - (perhaps longer term) Work with at least one commercial finite element software provider to implement quasi-static modal analysis as a built-in analysis routine.
- Develop collaborations with other faculty at BYU to expand my research portfolio and the connections built by my students.
- Work with Jerry Ginsberg to publish a second edition of "Mechanical Vibration," including many of the innovations that I have developed in teaching this subject.

1.3 Relationship to Department Goals and Needs

The goal of the Mechanical Engineering Department is to help mechanical engineering students develop the skills and knowledge necessary to become truly influential engineers in their chosen areas of expertise. I believe that some keys to achieving this goal are:

• Establish an increased presence of BYU students at key conferences in our research fields.

- Enable and motivate students to establish a strong base of engineering and mathematical insight and technical skills and teach students to use that to tackle research challenges with confidence and energy.
- Help students to obtain employment in influential positions as faculty members (with doctoral degrees at other institutions or at BYU), at national laboratories and in industry.

1.4 Required Resources

- Lab space for experimental equipment and office space for students.
- Funds for travel to conferences and to visit collaborators at national labs.
- Graduate and undergraduate students with an appropriate skill set.

1.5 Progress to Date

- I have fifteen years of experience doing much of what I outline above at the University of Wisconsin-Madison. At this point I am only in the very early stages of translating that to BYU, although I have already recruited two excellent undergraduate students and managed to train them to contribute to research in just a few months.
- I have already submitted one proposal to NSF and am in the process of submitting one to KC-NSC and another to Sandia.
- I am slated to teach ME EN 335, which I believe will be an ideal pipeline for recruiting undergraduate and graduate students.
- My lab equipment was transported to BYU and is in the process of being assembled/installed. One experiment is up and running and two others still require attention.
- I have learned a lot about mentoring and managing an effective research group and believe that I am well positioned to establish a strong group at BYU.

2. CITIZENSHIP

2.1 Self-Assessment

2.1.1 Strengths, Skills, and Competencies

- I have good leadership skills and am an influential member in many of the circles in which I work and have received invitations to lead in various capacities.
- I have been highly sought after for my abilities to contribute to leadership on University, College of Engineering and departmental committees.
- I am a reasonably effective associate editor for Experimental Techniques and have served in a similar role for other journals.

2.1.2 Areas for Improvement or Growth

- My research accomplishments have not yet garnered sufficient attention for me to earn any prestigious awards, such as the DeMichelle or Brewer Awards at SEM or the Lyapunov award at ASME.
- I could benefit from developing a more robust network of reviewers in my role as associate editor, and beginning to influence the practices used by the journals in which I am involved.
- I need of better skills for managing the time that is consumed by service work at the various levels of the department and university, and to balance this with other roles.

2.2 Professional Goals

2.2.1 Goals to Complete by Dec. 31, 2021 (Fall Semester 2021)

- Finalize planning for the 2022 International Modal Analysis Conference, and find a way to maximize impact in spite of the need for a hybrid format due to COVID.
- Provide timely reviews for all journal articles that come to me as an associate editor for Experimental Techniques.

Other Short-term plans (1-4 years)

- Complete my term as the Advisory Board Chair for IMAC in a way that strengthens the conference and the Society for Experimental Mechanics as the "friendly society."
- Seek a more influential Associate Editor position once my term with Experimental Techniques expires, perhaps with a journal that employs a new model for publishing.
- Limit my involvement in departmental and university committees when I do not feel that my contributions will have significant impact and maximize my contribution to committees that I believe will have important impacts.

2.2.2 Long-term plans (5-8 years)

- Obtain a prestigious award from SEM or possibly ASME.
- Nominate my former students for awards with SEM, ASME and/or AIAA.
- Serve as the President (or in other influential roles) for the Society for Experimental Mechanics.

2.3 Relationship to Department Goals and Needs

Two important goals of the department are to increase its visibility and elevate its graduate program. My service in the roles mentioned above will bring very significant visibility to the department and will enable the students who are involved to develop networks of international collaborators and a better sense of the most fruitful research that is going on internationally.

2.4 Required Resources

- Time to fulfill citizenship requirements.
- Travel funds for conference meetings, obtained by research proposals.

2.5 **Progress to Date**

- Associate editor for Experimental Techniques.
- Past guest editor for Mechanical Systems and Signal Processing and the ASME Journal of Vibration and Acoustics.
- My students have won various best paper awards over the past 10 years and one student won the Sage Young Investigator Award.

3. TEACHING

3.1 Self-Assessment

3.1.1 Strengths, Skills, and Competencies

Some of my core strengths as a teacher are:

- Expecting a high level of performance from the students and earning their respect in this regard.
- Motivating my instruction with real world examples and infusing a love of learning.
- Working well one-on-one with students both in teaching and mentoring.

I have developed over six courses over the past 15 years, most at the graduate level, and I have a strong sense of how to deliver engaging lectures and how to create assignments that encourage learning.

3.1.2 Areas for Improvement or Growth

I tend to struggle to put myself in the shoes of the students and to effectively gauge when they are with me and when they feel beyond their comfort zone. I also struggle to put together assignments that guide them step-by-step in learning but rather tend to throw them into the deep end and expect them to swim.

My current practices are not the most time efficient in terms of the work required to reproduce the same class each semester nor in managing grading so I can give timely feedback. I think I would be well served to fix my classes to a schedule that repeats each year with minimal modification and to work within that constraint.

3.2 Teaching Goals

3.2.1 Goals to Complete by Dec. 31, 2021 (Fall Semester 2021)

- Develop notes to teach ME EN 335 for the first time in Fall 2021 and ME EN 437 Kinematics for Winter 2022.
- Survey students in ME EN 335 to see how my teaching is going and how I could improve.

Other Short-term plans (1-4 years)

- Hopefully take on teaching of ME EN 534 Dynamics of Mechanical Systems and ME EN 535 Mechanical Vibrations in the near future.
- Develop a graduate course in my area of expertise and that will serve as an effective vehicle for training my graduate students.
- Survey my students regularly and learn to communicate in a way that keeps them engaged and makes them confident to ask questions when they are confused.

3.2.2 Long-term plans (5-8 years)

- Incorporate the text books that I am helping to write into my teaching and increase their visibility for teachers at other institutions.
- Explore innovative ways to assess student learning that don't put an undue burden on the instructor or that focus the instructors work on those activities that will have the most impact.

3.3 Relationship to Department Goals and Needs

The key to developing influential engineers will be to increase their technical skills so they will be sought after as those who understand the important issues and know how to use the latest tools. Furthermore, if we can hold them to high standards and enable success, we may increase their confidence to learn and contribute at the highest levels – in the most prestigious research circles and universities.

3.4 Required Resources

- Opportunity to teach same class multiple semesters.
- Opportunity to focus time teaching those courses that I can teach most effectively.
- TA wages.
- Teaching load that allows time to develop new courses.

3.5 Progress to Date

- My student reviews at UW-Madison showed that I was respected by my students, that they felt that the courses were important, and that they sensed that I cared for them as individuals.
- Those same reviews also consistently revealed that the students found the courses to be extremely challenging, more so than I would have expected or intended, and yet students would seldom express these concerns in class.
- I have taught courses similar to many of those that I will likely teach at BYU, but none is an exact match and so a very significant effort will be required as I develop new courses.

SCHOLARSHIP STRATEGIES PROJECT PROPOSAL

Overview

To be successful as a scholar, several key components are needed:

- 1. Establishment as an expert in an area by contributing to the state-of-the-art
- 2. External funding to support students and equipment
- 3. Presentation and dissemination of high quality research at conferences and peer reviewed journals

The focus of this project proposal is to significantly impact the field of environmental vibration testing.

4.2 Goals to be completed by December 31, 2021 (Fall 2021)

- Write a proposal to the Kansas City National Security Campus.
- Complete setup of large shaker system that was purchased from UW-Madison

Goals to be completed by May 2022

- Recruit 1-2 students to help in this work, either advanced undergraduates or a MS/PhD student.
- Write a review paper on fixture design for environmental testing (and possibly addressing environment definition and force-limiting).

4.3 Strategies for Productivity

- Invite students to present at least monthly at research group meetings
- Help students to find small questions/problems that they can pursue the answer to independently so they can experience the thrill of discovery.
- Engage with researchers at Sandia Labs by inviting them to have a joint research group meeting or possibly visiting Sandia.

4.4 Evaluation of Productivity

- Completion of the tasks above
- Quality of and number of references in the review paper.
- Number of journal/conference papers submitted and accepted
- Number of proposals submitted and accepted

CITIZENSHIP PROJECT PROPOSAL

Overview

As a new faculty member at BYU, I do not yet have many citizenship duties, although I am already serving on a few MS/PhD committees and am beginning to engage with other faculty regarding course development. My goal for the next year will be to discover where my abilities may best be put to use and to engage in a set of citizenship activities that will maximize my impact while minimizing the time burden.

5.2 Goals to be completed by December 31, 2021 (Fall 2021)

- Attend meetings of the ME/Physics Acoustics Research Group
- Engage with BYU's AIAA group

Other Goals

- Engage with BYU's rocketry group
- Evaluate the department's system for PhD qualifier exams (preparing, offering, helping students to prepare) and consider areas for improvement
- Evaluate the department's system for nominating faculty for national/international awards and suggest areas for improvement.

5.3 Evaluation

- Completion of tasks above in a reasonable timeframe
- Engagement in a reasonable but not excessive level of citizenship

COURSE DEVELOPMENT PROJECT PROPOSAL

Overview

The course I want to focus on for course development is ME 335 – System Dynamics, that I will be teaching in Fall 2021.

6.2 Course Purpose

The purpose of this course is to help students to strengthen their physical intuition and understanding of the behavior of dynamic systems and to develop the skills needed to quantitatively/computationally predict their behavior.

6.3 Student Progress Assessment

- Performance of students on exams
- Level of engagement of students in class asking questions, working on homework, etc...
- Final project in which the students apply what they have learned to model a real system. This will be graded in a binary fashion, so the level to which they engage will be a good indicator of their interest in the subject and abilities.

6.4 Evaluation

- Invite a faculty member to visit and provide feedback.
- Offer a survey to students mid-semester focusing on: 1.) organization and clarity of the instructor's communication, 2.) whether the instructor cares about their spiritual growth, 3.) whether the course/homework/exams are fair.

6.5 Syllabus

Next page.

Course Description:	Formulating mathematical models for mechanical, electrical, fluid, and combined systems; numerical solution of motion equations; first- and second-order systems, frequency response, and transfer functions.					
Prerequisites:	ME EN 273 & CE EN 204 & EC EN 301; pre- or concurrent enrollment in					
	MATH 303 O	OR MATH 334.				
Class Time:	<i>MWF</i> 8:00-8:50 PM, 254 CB.					
Instructor:	Name					
	Office:					
		(or by appointme	(nt)			
		<u>@byu.edu</u> (contac		not through	h Loorning S	Surita)
	Phone:	<u>yoyu.edu</u> (contac	t me tins way,	not unrough	i Learning c	suite)
		020/	C	720/		
Grading Scale:	A	93%	C	73%		
	A-	90%	C-	70%		
	B+	87%	D+	67%		
	В-	80%	D	63%		
	C+	77%	E	0%		
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ME EN 335 – Dynamic System Modeling and Analysis

Fall 2021

Exams:	There will be one midterm and a comprehensive final. You will not be allowed to
	make up a missed exam, unless (1) in case of an emergency, and (2) you let me
	know beforehand (even if it's just a phone or email message – but it MUST be
	left before the exam).

Learning Outcomes:

Mechanical Systems

1. Students should have a knowledge of fundamental systems concepts required to develop lumped element models for basic mechanical systems, including inertia, compliance, dissipation, and power sources, and obtain equations of motion for linear motion and fixed-axis rotation. Electrical Systems

2. Students should have a knowledge of fundamental systems concepts required to develop lumped element models for basic electrical systems, including inductance, capacitance, resistance, power sources and amplifiers.

Basic Fluid Systems

3. Students should have a knowledge of fundamental systems concepts required to develop lumped element models for basic fluid systems, including inertance, capacitance, resistance, and pumps. Multi-domain Modeling

4. Students should have a knowledge of fundamental concepts of multi-domain modeling of electromechanical and fluid/mechanical systems and be able to develop lumped element models of these mixed systems.

Simulation Software

5. Students should know how to place equations of motion into state variable form, and to develop a simulation for basic non-linear and linear systems using MATLAB or some other simulation software. Transfer Functions and Poles

6. Students should know how to manipulate a system of linear differential equations to obtain transfer functions and poles (eigenvalues).

Interpret Poles

7. Students should understand first and second-order systems and know how to interpret poles (eigenvalues) to define natural frequencies, damping ratios, time constants, and the natural response, step response, and impulse response of a system.

Frequency Response

8. Students should understand the concept of frequency response. They should understand the relationship between transfer functions and frequency response, and should be able to obtain frequency response plots for their system models using MATLAB.

Real World Application

9. Students should use the BYU ME method to 1) transform a real-world dynamic system into an engineering problem and 2) develop and analyze a lumped-element model to solve the engineering problem. Students communicate their process and results to others.

Schedule – See Learning Suite

University Policies Honor Code

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and every instructor's expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

Preventing Sexual Misconduct

As required by Title IX of the Education Amendments of 1972, the university prohibits sex discrimination against any participant in its education programs or activities. Title IX also prohibits sexual harassment-including sexual violence-committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of "Sexual Misconduct" prohibited by the university.

University policy requires any university employee in a teaching, managerial, or supervisory role to report incidents of sexual misconduct that come to their attention through various forms including face-to-face conversation, a written class assignment or paper, class discussion, email, text, or social media post. If you encounter Sexual Misconduct, please contact the Title IX Coordinator at t9coordinator@byu.edu or 801-422-2130 or Ethics Point at https://titleix.byu.edu/report or 1-888-238-1062 (24-hours). Additional information about Title IX and resources available to you can be found at http://titleix.byu.edu.

Student Disability

Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 422-2767. Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. The UAC can also assess students for learning, attention, and emotional concerns. Services are coordinated with the student and instructor by the UAC. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422-5895, D-285 ASB.

Mental Health

Mental health concerns and stressful life events can affect students' academic performance and quality of life. BYU Counseling and Psychological Services (CAPS, 1500 WSC, 801-422-3035, caps.byu.edu) provides individual, couples, and group counseling, as well as stress management services. These services are confidential and are provided by the university at no cost for full-time students. For general information please visit https://caps.byu.edu; for more immediate concerns please visit http://help.byu.edu.

Devotional Attendance

Brigham Young University's devotional and forum assemblies are an important part of your BYU experience. President Cecil O. Samuelson said, "We have special and enlightening series of devotional

and forum assemblies...that will complement, supplement, and enrich what will also be a very productive period in your classrooms, laboratories, and libraries. We look forward to being with you each Tuesday...and hope that you will regularly attend and bring your friends and associates with you...A large part of what constitutes the unique 'BYU experience' is found in these gatherings where the Spirit has been invited and where we have the opportunity to discuss and consider things of ultimate worth and importance that are not afforded to the academic community on almost any other campus" (from the address "The Legacy of Learning", 30 August, 2005). Your attendance at each forum and devotional is strongly encouraged.

Respectful Environment

"Sadly, from time to time, we do hear reports of those who are at best insensitive and at worst insulting in their comments to and about others... We hear derogatory and sometimes even defamatory comments about those with different political, athletic, or ethnic views or experiences. Such behavior is completely out of place at BYU, and I enlist the aid of all to monitor carefully and, if necessary, correct any such that might occur here, however inadvertent or unintentional. "I worry particularly about demeaning comments made about the career or major choices of women or men either directly or about members of the BYU community generally. We must remember that personal agency is a fundamental principle and that none of us has the right or option to criticize the lawful choices of another." President Cecil O. Samuelson, Annual University Conference, August 24, 2010 "Occasionally, we ... hear reports that our female faculty feel disrespected, especially by students, for choosing to work at BYU, even though each one has been approved by the BYU Board of Trustees. Brothers and sisters, these things ought not to be. Not here. Not at a university that shares a constitution with the School of the Prophets." Vice President John S. Tanner, Annual University Conference, August 24, 2010

Plagiarism

Intentional plagiarism is a form of intellectual theft that violates widely recognized principles of academic integrity as well as the Honor Code. Such plagiarism may subject the student to appropriate disciplinary action administered through the university Honor Code Office, in addition to academic sanctions that may be applied by an instructor. Inadvertent plagiarism, which may not be a violation of the Honor Code, is nevertheless a form of intellectual carelessness that is unacceptable in the academic community. Plagiarism of any kind is completely contrary to the established practices of higher education where all members of the university are expected to acknowledge the original intellectual work of others that is included in their own work. In some cases, plagiarism may also involve violations of copyright law. Intentional Plagiarism-Intentional plagiarism is the deliberate act of representing the words, ideas, or data of another as one's own without providing proper attribution to the author through quotation, reference, or footnote. Inadvertent Plagiarism-Inadvertent plagiarism involves the inappropriate, but non-deliberate, use of another's words, ideas, or data without proper attribution. Inadvertent plagiarism usually results from an ignorant failure to follow established rules for documenting sources or from simply not being sufficiently careful in research and writing. Although not a violation of the Honor Code, inadvertent plagiarism is a form of academic misconduct for which an instructor can impose appropriate academic sanctions. Students who are in doubt as to whether they are providing proper attribution have the responsibility to consult with their instructor and obtain guidance. Examples of plagiarism include: Direct Plagiarism-The verbatim copying of an original source without acknowledging the source. Paraphrased Plagiarism-The paraphrasing, without acknowledgement, of ideas from another that the reader might mistake for the author's own. Plagiarism Mosaic-The borrowing of words, ideas, or data from an original source and blending this original material with one's own without acknowledging the source. Insufficient Acknowledgement-The partial or incomplete attribution of words, ideas, or data from an original source. Plagiarism may occur with respect to unpublished as well as published material. Copying another

student's work and submitting it as one's own individual work without proper attribution is a serious form of plagiarism.

Academic Honesty

The first injunction of the Honor Code is the call to "be honest." Students come to the university not only to improve their minds, gain knowledge, and develop skills that will assist them in their life's work, but also to build character. "President David O. McKay taught that character is the highest aim of education" (The Aims of a BYU Education, p.6). It is the purpose of the BYU Academic Honesty Policy to assist in fulfilling that aim. BYU students should seek to be totally honest in their dealings with others. They should complete their own work and be evaluated based upon that work. They should avoid academic dishonesty and misconduct in all its forms, including but not limited to plagiarism, fabrication or falsification, cheating, and other academic misconduct.

Deliberation Guidelines

To facilitate productive and open discussions about sensitive topics about which there are differing opinions, members of the BYU community should: (1) Remember that we are each responsible for enabling a productive, respectful dialogue. (2) To enable time for everyone to speak, strive to be concise with your thoughts. (3) Respect all speakers by listening actively. (4) Treat others with the respect that you would like them to treat you with, regardless of your differences. (5) Do not interrupt others. (6) Always try to understand what is being said before you respond. (7) Ask for clarification instead of making assumptions. (8) When countering an idea, or making one initially, demonstrate that you are listening to what is being said by others. Try to validate other positions as you assert your own, which aids in dialogue, versus attack. (9) Under no circumstances should an argument continue out of the classroom when someone does not want it to. Extending these conversations beyond class can be productive, but we must agree to do so respectfully, ethically, and with attention to individuals' requests for confidentiality and discretion. (10) Remember that exposing yourself to different perspectives helps you to evaluate your own beliefs more clearly and learn new information. (11) Remember that just because you do not agree with a person's statements, it does not mean that you cannot get along with that person. (12) Speak with your professor privately if you feel that the classroom environment has become hostile, biased, or intimidating. Adapted from the Deliberation Guidelines published by The Center for Democratic Deliberation.

(http://cdd.la.psu.edu/education/The%20CDD%20Deliberation%20Guidelines.pdf/view?searchterm=deli beration%20guidelines)

Inappropriate Use of Course Materials

All course materials (e.g., outlines, handouts, syllabi, exams, quizzes, PowerPoint presentations, lectures, audio and video recordings, etc.) are proprietary. Students are prohibited from posting or selling any such course materials without the express written permission of the professor teaching this course. To do so is a violation of the Brigham Young University Honor Code.