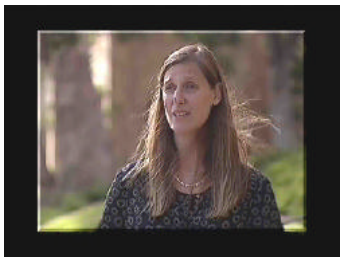
Sloan Career Cornerstone Center

Profiles of Mechanical Engineers



Adrienne Lavine

Professor, Mechanical Engineering
University of California at Los Angeles
Los Angeles, CA

Education:
PhD, Mechanical Engineering, University of California/Berkeley
MS, Mechanical Engineering, University of California/Berkeley
BS, Engineering, Brown University

Job Description:
Professor of Mechanical Engineering, involved in both teaching and research.

Advice to Students:
"You have to want to be a graduate student. I mean, you have to want to study all the time and think about your research."

Comments:
After two years with a manufacturer of Fiberglas products, Adrienne decided to continue her studies. Her work toward Master's degree encouraged her to continue on to the PhD. As a researcher she works on heat transfer and fluid flow problems that come directly from industry. She emphasizes the variety of career options for the person educated as a mechanical engineer.

Video Transcript 1:
"I'm a member of ASME, American Society of Mechanical Engineers and I go to their conferences about twice a year. This is the forum where academics present their research to one another and to industry. ASME has many other, other functions but that's the one that I am most involved in. And it's very valuable to me to go there and meet other people working on similar problems to mine and exchange ideas. And you know, after a while these get to be your friends and it's just a fun time, too. But networking, of course it's important in any work in any line of work to know who the other people are in your field and communicate with them."

Video Transcript 2:
"First of all, a degree in engineering is very valuable because it does not restrict you to being an engineer, to working in the engineering field. And lots of lawyers who first had engineering degrees, doctors who have engineering degrees, it's a good background. It teaches you to think in a logical way and is very rigorous. So it can lead to many different things. Certainly

business as well, you can get a business degree after an engineering degree or just go into some business venture after an engineering degree."

Interview:

Q: For the tape, your name, where you're working.

Lavine: All right, sure. I'm Adrienne Levine. I'm a professor here at UCLA, a lovely campus. Maybe you've heard of us, we're in Los Angeles. I teach mechanical engineering and my field of research is heat transfer. I can get more specific if you like.

Q: Get a little bit more specific.

Lavine: OK. The problems I've been working on recently have to do with how heat transfer affects machining and grinding, the very practical, down-to-earth engineering processes which can fail to work if the work piece gets too hot or the tool gets too hot. That can damage the material. So I write equations that describe the heat transfer in that process and the temperature distribution and, in that way, we can predict how hot the work piece will get. Let's say if you grind under certain conditions. And then we can optimize the conditions to keep the work piece from overheating. So it's very practically relevant to industry and really unusual for me because I came into engineering with a love of mathematics and this is very “nitty-gritty” engineering.

Q: Tell me how that happened.

Lavine: How I got into engineering?

Q: Yeah.

Lavine: Oh, well it all began when I was born. No, I always liked math and in my family, math was always something that you talked about around the dinner table. My oldest brother is a statistician but, you know, when we were growing up he would pose math problems to us. That was our entertainment. And so I always liked that. But, I thought that math was too much of a game because that's what it seemed to me. And I thought engineering would be an application of mathematics. So when I entered college, I put down “engineering” as my possible major and fortunately they didn't force me to choose right away. And I found that after initially getting over having a pretty bad professor in my first semester and thinking that I hated engineering, I got past that and ended up liking it. But it was always the math that carried me through. The physics was always a little tougher to understand for me and it's only been with many years of experience that I can understand physics now to some extent. But it was always the math that I'd fall back on. And I think if you have that mathematical ability, it serves you well in an engineering career or in the study of engineering. Certainly there are people who bring to engineering many different strengths. There are those who can just build things, you know, and it's amazing to me that anyone can create the sorts of things that, that they do create. And then there are people like me who have the sort of logical, analytical mind and I'm not so good at creating things. I don't think I'd ever be an engineering designer. But you bring together people with these different backgrounds and you can do wonderful things.

Q: When you decide that you really liked engineering?

Lavine: I haven't decided yet. No, there are parts of it that I love. It's always the mathematics. It's been an evolution but let me tell you what I love about the study of engineering. I love that you can write a simple equation on a piece of paper that seems very innocent and the one that is dearest to me that I'm thinking of is called the Navier Stokes equation and describes fluid mechanics. It describes almost every kind of fluid flow you could think of from the water flowing through your pipes at home to the atmosphere to the blood flowing in our veins and many other exotic flows. Just this little equation. We don't know how to solve it in any kind of general way. It's been solved for many specific cases. And the thing that is amazing to me, we understand the principles that govern fluid flows and that's why we can write the equation down. But that equation predicts flows that are much more complicated than we could have ever imagined when we wrote the equation down. So it's as if we just had this much understanding and the equation takes on a life of its own and tells us much more.

Q: Would you regard it as elegant?

Lavine: Elegant, magical even in a way.

Q: Well, take us back to the beginning. Where you were born, where you grew up.

Lavine: OK. I was born outside of Philadelphia but I mostly grew up in Princeton, New Jersey, a university town, a lovely sort of quaint town at the time. I didn't appreciate it growing up there, I just thought that was normal. It was only later I realized that most places are ugly and that was really terrific. But you know, I was surrounded by a lot of people related to the university somehow and so I think there was an appreciation for education there that you wouldn't find everywhere. And growing up in that town and growing up in my family, I always assumed I would get a bachelor's degree. And even in the back of my mind, I think I knew I would go on beyond that So I went to Brown.

Q: How did you pick Brown?

Lavine: It had a reputation. It's an Ivy-League school but it had a kind of a quirky reputation. I've called it sort of a “hippie” school and that appealed to me at the time. That manifested itself in the new curriculum which meant that you could take pretty much anything you wanted. Well, within engineering there were many requirements but you didn't have to take, you know, one humanities from this category, one history. You could really design your own curriculum. You could take as many courses as you wanted “pass/fail,” because the idea was you're here to learn. If grades are going to get in the way of that, let's get rid ofr them. Well, I took some courses pass/fail in the beginning and when I realized I was getting A's in them, I changed because what a waste. I had fun at Brown. I met a lot of smart people, had some good teachers and some abysmal teachers. I think it was some of those abysmal teachers that first planted the seed that, “Oh, I could probably do this better. So maybe that's a career for me.” Although I didn't think about it seriously for a long time. I went to Brown in the late seventies and there was the energy crisis in this country, the oil crisis, and there were lines at gas stations, oil shortages, and I became interested in energy conservation. It was big then and it's coming back in vogue now. So I chose mechanical engineering because one aspect of mechanical engineering is power and energy use and conservation. And I got a job when I

graduated, at Owens-Corning Fiberglas. They're the ones who make the pink insulation, you know, the Pink Panther is their spokesman, “spokes animal,” whatever. And we were doing some research at their technical center on how you could build a house to conserve energy for heating and cooling. You know, basically how much of this pink stuff can you stuff in the walls to sell Owens Corning products. But it was very interesting and I got a taste of what research was like at that stage, after my bachelor's degree, which is something I think most engineering graduates are not exposed to. They're probably more often in a design environment or something like that. But that was fun. And after two years there, I guess I felt that I wasn't growing very much and that I should get further education. And because of this experience, I chose heat transfer to study; heat transfer being the study of just about anything where you care what the temperature is. That's how I think of it. Am I filling in enough details?

Q: You're doing fine.

Lavine: OK. I chose Berkeley at that time because it had an excellent reputation and specifically in the heat transfer field. And I think when you select a graduate school, since you are going to be really focusing on a specific area, it doesn't only matter that it's generally a good school but it also matters that they are strong in the particular area that you're interested in. And you might even want to, you should really talk with the faculty in that area and see what kind of research you might be doing with those faculty. Because it can happen that you find just a wonderful faculty member at a school which is OK but not great except this wonderful person is there and they're doing research that's just fascinating to you. Well then you should probably go to that school. So I chose Berkeley. Now I didn't always choose things with complete understanding of what I was doing. I got hooked up with my advisor there, a wonderful gentleman, a very kind person. He was working on a project that had to do with solar engineering, nominally, that was appealing to me because of where I had come from, the energy conservation aspect of it. But very quickly I came to realize that this was a very fundamental study of a fluid flow, and again, there's my love of the Navier Stokes equation. And I was able to use my mathematical ability in that research project. Being in graduate school is wonderful. I liked it better than undergraduate. Why did I like it better? I don't know, I could really focus in on some pretty narrow area and just make it mine, you know. I could learn everything about that little very well-defined subject area and have a feeling of mastery over it. And I was also working with other graduate students who were themselves intent on this pursuit of knowledge. And we had a great time. And I made friends there who are still my best friends today and this is twelve years after I graduated. It was a good time, a good time to work very hard. I worked very hard, really focused on my studies, but it was a wonderful and exciting time.

Q: Talk about what graduate student life is like.

Lavine: OK. You have to want to be a graduate student. I mean, you have to want to study all the time and think about your research. Well, of course, there's classes. You take classes for two, two and a half years, something like that. And then the rest is your research. I'm really talking more about a Ph.D. than a Master's degree. With a Master's degree, some universities have you do a thesis and some don't. And some give you the option. But for a Ph.D. there's always a thesis and that's where you really learn how to approach a problem and conduct research and contribute to the state of knowledge in your field. And that's a sort of a heady undertaking, to think that you can contribute something that no one else knows at the moment.

But I said you really have to want to do it because you're going to be working all the time, you know. That your life is studying and taking exams and doing your research, running your code or running your experiment or whatever it is late at night and on weekends. And I had a lot of fun, too. But you know, it never got in the way -- it was always secondary to the work. And so if you're willing to be dedicated in that way, it's extraordinarily rewarding. One contrast between being a student and being a professor is, that as a student you're really responsible mainly to yourself to making sure that you understand what you're supposed to understand and that you produce the research that is your thesis. You have to make your advisor happy, but essentially your goals are the same as your advisors. So you're responsible to yourself, you don't worry about other people, you get your work done. It's very focused and satisfying.

Q: Is it actually possible to teach somebody something?

Lavine: Well, you certainly can't teach someone something if they're unwilling to learn. And you know, I was talking with someone recently about evaluation of teaching, which is something we're always doing at the university. And she made the point, the very valid point, that really what you should be doing is evaluating whether the students have learned, not whether the professor has taught well. Because it doesn't matter how well you teach if the students don't learn. So it's a consensual relationship between the teacher and the student.

Q: What is your job title now?

Lavine: Associate professor. When you're hired into a university, typically if you don't have many years of experience you would be hired as an assistant professor. And then after a period of somewhere around six years, you would be evaluated for tenure. The decision at that point is whether to give you tenure, meaning that you have a job at the university pretty much guaranteed forever, or to terminate your employment. So you know, it's high or low and nothing in between. When you get tenure, usually at most universities you become an associate professor at the same time. So I've been an associate professor now for five years and the next step is full professor which actually I'm being evaluated for now. As we speak, people are meeting in a dark room somewhere to discuss my fate. But let me say something about what the responsibilities of an academic are, what the career entails. Our responsibilities at a research university like UCLA are both to teach and to conduct research. I think that many students don't realize that teaching is not our sole or even our primary responsibility. But it's this dual, these two, two very important paths, teaching and research. Teaching is wonderful. I think it's wonderful to have that interaction with students, most of whom really want to learn what it is you're teaching them. To try to present material in a way that they can learn, to give them assignments and exams that challenge them to think and help them to learn. I think that's really fun. And when I teach, I kind of feel like I'm on stage a little bit and I sort of get into a little bit of a character. I try not to go overboard but, you know, sort of play around a little. Make stupid jokes which usually don't get a laugh but what can you do? So that's teaching. The bad thing about teaching is it's the same over and over again pretty much. I mean, you know, engineering changes very slowly so a lot of what we teach is very fundamental, so it stays the same. I mean, heat transfer is a classical field that's been understood for many decades and so I teach the same thing over and over again. Research, on the other hand, is always new by its definition. We are trying to learn new things at the boundaries of knowledge. So it's very challenging and can be very exciting and rewarding. But what frustrates me about research is that in order to do it, you need money to do it. And

the way universities are structured, each individual faculty member brings in money to do their research, brings in from federal agencies like the National Science Foundation or industry. Those are the main, two main sources, federal agencies and industry. And that's very competitive to bring in that money. And without it, it's very hard to do anything. You need money to support students because they need to eat, to live. And you need money to do experiments, to buy equipment. You need money sometimes for computers and also we're paid for nine months so we'd like to have money to pay those additional three months in the summer. So that's tough to go after the money and to sell yourself. So there's a little bit of an entrepreneurial aspect to being a professor which I didn't really know until I got here and it doesn't suit me that well. Oh well, no job is perfect. When I think about this job, you know, sometimes I get discouraged with some of the difficulties of my job, then I try to think about what I would be doing in some other job and I really can't think of one that would be better. There's a huge amount of freedom in a teaching position, freedom in what you research, freedom in how you teach your classes, freedom in when I care to arrive and leave. I mean, no one's looking. I could work, do all my work at home. I could do all my work between midnight and six A.M. No one cares. So it's very flexible now as well. And it suits me very well right now because I have two young children and they have their schedules and have to be taken to school and picked up and whatnot, and then I can work around that.

Q: Do you think at all about whether this is going to be your lifetime career or whether this is what you're doing now? How about the options, that sort of thing, things that you weigh?

Lavine: Well, in my life I've always made my decisions at the last minute. I haven't really planned ahead. I chose engineering kind of on a whim and stuck with it. After I worked for a couple of years, I decided to go back to graduate school but I didn't know if I just wanted a Master's degree or a Ph.D. And up until the last minute when I had to decide, I hadn't decided. And then I said, “OK, I'll stay on for the Ph.D.” And then when it came time to graduate and I needed to start interviewing for jobs, my advisor said, “You should really consider teaching.” And it really wasn't until then that I decided that that's what I would do. So I don't plan that far in advance. So now you ask me, “Am I going to be in this job forever or not?” I don't know. For right now, it's an excellent job. As I said before, there are aspects of it that are frustrating to me but when I compare it to anything else, I think it's really a very rewarding and wonderful job. And maybe something else will come along and I'll change, but no, at this point I think I'm here.

Q: What can you say about keeping options open?

Lavine: First of all, a degree in engineering is very valuable because it does not restrict you to being an engineer, to working in the engineering field. And there are lots of lawyers who first had engineering degrees, doctors who have engineering degrees; it's a good background. It teaches you to think in a logical way and is very rigorous. So it can lead to many different things. Certainly business, as well. You can get a business degree after an engineering degree, or just go into some business venture after an engineering degree. So, beginning with engineering you're pretty flexible. Mechanical engineering is also very broad. So, if you're thinking about what engineering field to enter and you're not quite sure, mechanical's a good one because there are mechanical engineering problems in many different industries and there's always mechanical engineering problems in everything. Heat transfer is wonderful

because there's heat transfer in everything. In computers, heat transfer is just essential because you have these little tiny chips that are generating a lot of heat. And if that heat cannot get out of the computer, the computer will overheat and not operate. And we all know that heat transfer is important in the space shuttle and in building-heating and cooling, and in our bodies. Anyway, heat transfer is wonderful. Very flexible. I suggest it strongly but I'm partial. So keeping your options open is always a wise thing, and certainly engineering is something that does keep your options open. When you're completing your undergraduate degree and aren't quite sure what to do next, again, keep your options open, take the GREs so you can go to graduate school if you want to, look into job opportunities. I worked for two years and then went back to school. So you can always change your mind. At this stage, I'm not sure how I keep my options open except that, of course, I'm always learning new things so I guess, I guess I am keeping my options open.

Q: Networking, the professional societies and that sort of thing?

Lavine: I'm a member of ASME -- American Society of Mechanical Engineers -- and I go to their conferences about twice a year. This is the forum where academics present their research to one another and to industry. ASME has many other functions, but that's the one that I am most involved in. And it's very valuable to me to go there and meet other people working on similar problems to mine and exchange ideas. And you know, after a while these get to be your friends and it's just a fun time, too. But networking, of course it's important in any line of work to know who the other people are in your field and communicate with them.

Q: What are your thoughts on "globalization?"

Lavine: Well, I think there's always been an attitude about academics that we should know what's going on around the world since research knows no boundaries, no national boundaries. Language, of course, is a barrier to being aware of research around the world. Fortunately for us, most people speak English. I have tried to read translations of Russian literature sometimes, and found them to be nearly unintelligible. But, if you're going to be discovering new things or doing research you really need to be aware of what's going on around the world. I think that's always been true. The world is becoming more open now and it's easier to communicate with people via E-mail or the Web or whatever. And so it will become easier. But, I don't think there's a change in perspective because I think it's always been there and we need to be aware of what's happening in the entire world.