

Reminiscences of Raymond D. Mindlin on the occasion of the hundredth anniversary of his birth

Bruno A. Boley's talk on Raymond D. Mindlin, June 26, 2006, Boulder, Co.

I am pleased and honored to open officially the Mindlin Centennial symposium, and I am not at all unhappy at having been upstaged by the preceding announcement of the impending establishment of a Mindlin medal by ASEE. We are all acting together to honor Raymond Mindlin as a great man on the one hundredth anniversary of his birth. Mindlin was certainly someone different, someone special, and indeed someone great. Why do we say that? As evidence of his greatness we can describe his work, of course, and Professor H. S. Pao who will follow me on this podium, will indeed do that. For the moment, I will limit myself to mentioning his solution of the Mindlin Problem - the effect of an arbitrary force in the interior of an elastic halfspace - which lies directly in the tradition of Boussinesq and Cerruti among the Italian elasticians of the late 1800's, who had solved special cases of it. But all his work, be it theoretical or experimental (he was in fact very proud pioneering achievements in photoelasticity), be it in elasticity, vibrations, wave propagation, contact problems, crystal resonance, granular media, continuum microstructure theory, lattice theory, all his work was in fact at the same time advanced and traditional. For example, the topic - though not the contents - of his last paper (the vibrations of a rectangular plate with free edges) would have been familiar already in the time of Kirchhoff.

We might also consider Mindlin's applied work, as evidenced by his consulting. He consulted for the then legendary Bell Telephone Laboratories, the Applied Physics Laboratory at Johns Hopkins, the Terrestrial Magnetism Department of the Carnegie Institute of Washington, and numerous other governmental and private organizations. To summarize these, and to combine in the same sentence the ridiculous and the sublime - and I let you choose which fits in which category - I will note that he won the Presidential Medal of Merit when he was not yet a full professor at Columbia, and that he was able to command a four-figure hourly honorarium at a time when New York subway fare was still a nickel.

Or we might look at the awards he received. Among these are, of course, the ones you would expect - the von Karman Medal, the Timoshenko Medal, the Frocht Medal of the Society of Experimental Stress Analysis, the National Medal of Science, Membership in the National Academy of Engineering, National Academy of Sciences, and the American Academy of Arts and Sciences, the Egleston Medal from Columbia University - and some you have probably never heard of - such the C. B. Sawyer Piezoelectric Resonator Award.

All of Mindlin's individual achievements, such the ones we have enumerated, are certainly important, but not sufficient for the attribute of greatness, and perhaps not even necessary. The total person is bigger than the sum of the parts, as anyone who had known Mindlin would have readily recognized. There is a quality of greatness which is in a sense absolute, not based on comparison with others or on statistics.

Real greatness is not relative or probabilistic, it is always anecdotal and personal.

I hope, therefore, that you will not mind if I continue in an anecdotal and personal vein and try to describe, however inadequately, Ray Mindlin the person. And if in so doing I frequently use my own personal experiences, please excuse them as having the virtue of being the report of a witness rather than being mere hearsay.

Mindlin was a New Yorker, through and through. He was born in New York, of course. He attended the Fieldstone School of the New York Ethical Culture Society (which was frequented by many Jewish families and others), a fact which I know was important to him, because he mentioned it several times, though never, as far as I could tell, with any particular degree of affection.

He then entered Columbia University, was on the Varsity, and got his B.A. degree. He then stayed on as an undergraduate still, and it is my suspicion that in the three years it took him to get a B.S. degree, he formed his lifelong habit of digging deep for understanding, for "getting his fingers dirty", to use his favorite phrase.

He continued until his Ph.D., for which he wrote his thesis on the solution of the Mindlin problem. I understand that the Dean, James Kip Finch, accepted it saying that he understood nothing about it, but knew enough to know that it was important (I mention this to indicate how different those times were, when Deans took an actual interest in such things). He only requested that it be lengthened a little: it was extremely short, it just said 'this is the problem and this is the solution'. Mindlin added a couple of pages of background, but it probably remained the shortest thesis on record.

He rose in the Department of Civil Engineering at Columbia, though he was never Chairman of the Department, nor did he want to be. He wanted to be, and was, the cultural and intellectual center of the Department, no important decision was ever made without him, but all details were left to the Chairman, Jewell Garrelts, who did very well and who managed to keep the peace and handle the various stars in the Department, among them of course Mindlin; and I suspect in fact that Mindlin enjoyed being so "handled".

Not that he always minded dealing with administrative details: Mindlin for example ran for years the annual ASME Applied Mechanics Dinner, traditionally held at the Columbia Faculty House, until he got bored with the job and handed it over to me. And it was a good thing too, because when he received the Timoshenko Medal (normally bestowed at that dinner) he was not obliged to be his own host, so to speak. He was worried enough about having to give the acceptance speech for that Medal, a sort of social, after-dinner speech, and in fact wound up giving much too technical a presentation.

I met Mindlin when I joined Columbia in 1952. I never worked with him, I was a colleague, not a collaborator, and the simplest explanation for this would be that we worked in different fields, but that would be misleading, because no part of solid mechanics was out of *his* field. When he learned, for example, that I had worked on thermally induced vibrations, his reaction was "Oh, I see, this is that kind of interaction" between thermal and mechanical effects, and proceeded to put it in perspective, giving me a detailed lecture on various kinds of interactions, thermal, mechanical, piezoelectric, magnetic and even chemical.

He had the same kind of reaction when he heard me give a paper (as it happens at

an early version of the present National Congress of Theoretical and Applied Mechanics, in Urbana, Ill.) on the possibility of a Dynamic Saint Venant's Principle. His reaction was actually a devastating (to me) remark from the audience of "I don't see what you did there!". It took me years to understand that he did not mean that it was wrong, or stupid, or incorrect, but simply "of course that's how it would turn out to be".

His course on the Theory of Elasticity was the crown of the Department, not one used to separate the sheep from the goats among the graduate students, but one with which all others could be compared. Elasticity was a live subject to him, he did not blindly repeat the course year after year, but assiduously reviewed his lectures anew. When my wife once attended his course, during his discussion of the Maxwell-Morera stress-functions in three-dimensional elasticity, she mentioned that they could be extended to include the presence of body forces. He looked at her and said nothing; and it wasn't until the subsequent year that a student told me that Mindlin had presented a treatment of the 3-M Functions - namely the Maxwell-Morera-Mrs. Boley Functions - and he himself told me later that he had so labeled them in his notes.

He was thus always open to new ideas, and deeply valued his many excellent students for them. He was at the same time quite aware of students' failings. As a rule, in the publication of a completed thesis, the student's name appeared alone, Mindlin adding his name only when a specific contribution of his own was to be noted. But, as he said, when he (Mindlin) had explained the thesis to the student after its completion, and the student still did not understand it, then Mindlin placed his own name first. Similarly, upon hearing my limerick:

A graduate student of old
Was cut of an uncommon mold:
Whenever perplexed
As to what to do next,
He just sat around until told

he guffawed, but objected that the ironic "uncommon" should really be changed to "common" to make sure that everybody got the point.

I mentioned earlier my dear departed wife Sara, but in this too, Mindlin surpassed me. He lost not one wife, but two, Elizabeth and Pat, to both of whom he was clearly devoted. What his inner feelings were, I cannot pretend to know, though he was certainly a person of feelings. In evidence I adduce his favorite composer. With his own admiration, and almost fetish, for accuracy and precision, one might expect this to be one of the classical composers - no, his favorite was Frederic Chopin. There is nothing inaccurate or imprecise about Chopin, but he is clearly the quintessential Romantic, and Mindlin felt that his music was the only one that really spoke to his heart.

Among his other non-scientific interests, Mindlin, though certainly not an athlete, had been a runner, a sprinter to be precise. He was a regular jack rabbit at the start of a race: if there had been such a thing as a five meter race, he would have won it all the time and I understand that professional athletes used to come to watch him and to study his technique in sprinting.

His interest in speed extended to his interest in sports cars. He was amused by having his good friend Eli Sternberg tease him with the query of "You gotta Bugatti?" - a Bugatti being of course one of the luminary names of the Golden Age

of automobiles, like a Maserati or a Ferrari. Mindlin did not have one of those, but his Jaguar was certainly a worthy member of the clan, and he used to enjoy recounting how one day when he was driving home on one of the highways north of New York, a State trooper on a motorcycle approached him and motioned him to follow him. So there he was speeding faster and faster on the Taconic Parkway, wondering if the trooper was entrapping him into a speeding ticket. Not so; when the trooper stopped, he asked him many questions on the machine, could he have gone much faster?, and finally told him that any time he wanted to open up, he should look for him on that stretch of the parkway and he'd make sure he had no problems. Finally, he asked him what he did for a living, and Mindlin replied that he was a professor. The trooper looked at him in disbelief, and said, "The funniest people own them things!". That was the part that Mindlin liked best, to be recognized as someone different, someone special, someone "funny" if you will - and to that list we would like to add, what the trooper certainly would never have, and in fact what understated, moderate Mindlin would never himself have added - someone great.

But I hope, Ray, that you will accept that addition coming from us, and that you will in fact not mind all these personal reminiscences. I know, I know, there is a problem, Ray: communications with you are not exactly straightforward these days, and chancy at best. I hope you are well, of course, but I have a special reason for addressing you directly: I hope in fact that that special twinkle still appears in your eyes when to the question "How are you?" you give your favorite whimsical reply "Fair to Mindlin".

And so, my friends, I ask you please to rise and to join me, if you are so inclined, in an applause in token of remembrance, recognition and respect for a great man, RAYMOND DAVID MINDLIN.