"TRY TO BE REALLY GOOD IN TWO FIELDS"
(MIROSLAV FIEDLER INTERVIEWED BY JEFF STUART)[1]

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Professor Miroslav Fiedler is well known for his extensive work in linear algebra, especially the role of special families of matrices in numerical analysis, the interplay of matrix theory and graph theory, and in particular, M-matrices and P-matrices. In recognition of his many contributions to linear algebra, in 1993, he was one of three recipients of the first Hans Schneider Prize. Dr. Fiedler has been a leader of the Czech mathematics community for more than three decades, and has earned multiple national awards for his mathematical contributions and his leadership.

J. S. How did you come to mathematics in general, and to linear algebra in particular?

M. F. In secondary school in Prague, my favorite subjects were mathematics and physics. When, in the final course, I won the mathematical problem competition in the journal Rozhledy matematicko-přírodovědecké[2], I decided that after graduation in 1945, I would enter the Charles University in Prague to study mathematics and physics.

For me, the most influential professors were Bohumil Bydžovský and Eduard Čech. Bydžovský, who had attended lectures of Eduard Weyr and had authored a book on determinants and matrices, lectured on classical algebraic geometry. Čech, well known for his results in topology and geometry, and who, in my opinion, was one of the last people who understood mathematics as a whole, held lectures on the fundamentals of geometry.

Although it was not easy to avoid political turbulences at Charles University after the communists took over power in Czechoslovakia in 1948, I successfully finished

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[2] Horizons in mathematics and natural sciences (Editor's note).

my studies by receiving the title RNDr. in 1950. Just a few days after graduation, by a coincidence which happens once in life, I heard that Professor Čech was organizing a program of higher mathematical studies for a group of about a dozen participants. So I applied and was accepted.

The goal of the program was to stimulate research in those modern and applicable parts of mathematics that were not taught before the war. (I should mention that during the war all Czech universities were closed.[3])

Already at the secondary school, I had admired the richness of properties in the geometry of a triangle. It seemed to me later that much of that could be true for higher-dimensional simplices. This, of course, needed, as the main tool, matrices. I had already some experience with the subject, but among other obligatory lectures, one was advanced linear algebra. We read Malcev's excellent book in Russian. (I also learned the Russian alphabet from that book.) I have liked the topic ever since.

J. S. What were some of the most important events, ideas or colleagues that propelled the development of your career?

M. F. My scientific career got a new impulse in Professor Čech's group. We received a stipend (my first earned money), and, in addition to listening to first class lectures (even on computer programming), we met once a week with Eduard Čech, who presented some mathematical problems. There were really excellent people. Let me mention just a few names: Ivo Babuška, Jaroslav Hájek, Jaroslav Kurzweil, Jan Mařík, Vlastimil Pták, and Miloš Zlámal. To encourage group bonding, we had an annual retreat week at a mountain resort.

In 1952, the Czechoslovak Academy of Sciences was founded, and Eduard Čech became the first director of the Institute of Mathematics. A good part of the group became the employees of the Institute. Both Mila (Vlastimil) Pták and I were located in a small room together, Mila writing a dissertation on functional analysis, and I, on simplex geometry using matrices. We discussed problems of iterative methods for solving systems of linear equations. Norms are a significant tool for measuring the rate of convergence. We succeeded in comparing the rates in the case of a special kind of matrices.

It was not easy to do research in Czechoslovakia in the 1950's. We had very limited access to foreign literature, and then, only Russian translations to acquaint us with western mathematical books. We were allowed to publish only in Czech or Russian, and starting around 1955, also in German.

My first visit abroad was to the Riemann-Tagung in Berlin in 1955. In 1956, I attended the Fourth Congress of Austrian Mathematicians in Vienna where I spoke

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[3] Hitler closed Czech universities as the revenge for anti-Nazi demonstrations in occupied Prague (Editor's note).

about the location of eigenvalues using norms. Olga Taussky-Todd and her husband John Todd were present and contacted me. Sometime later, John Todd extended to me an invitation to visit Caltech. For personal reasons (my first wife became seriously ill, she died in 1963), I postponed the visit until 1964.

Behind the Iron Curtain, reality was sometimes quite ridiculous. At a research institution, one had to report any contact with a foreigner. Once in Moscow, I wished to have a short chat with a famous linear algebraist I had never met before. To avoid bureaucracy, he preferred to meet and have a chat on a chair in a park.

After 1960, the political situation in Czechoslovakia was slightly better and the authorities allowed a group from the Institute (including Mila and me) to attend the ICM 1962 in Stockholm. There we met Richard Varga, Alston Householder and others. Mila discussed with Richard the similarity of our results and the priority questions, concluding independence. Alston was very interested in our results on generalized norms, and ever since, he extended invitations to both of us to attend the Gatlinburg meetings. A short time later, I even became a member of the Gatlinburg steering committee.

Just before 1960, I was asked by Štefan Schwarz, a prominent Slovak mathematician, to be an external reviewer for the doctoral dissertation of Professor Anton Kotzig. Schwarz said it was from graph theory, and that I need read only one book, König's, to learn everything I needed. Ever since, I have used graphs in my research wherever it was appropriate.

J. S. In the 1950's and 1960's, matrix theory was widely considered a useful tool but not a serious subject for research, and yet you and Professor Pták did significant work on M-matrices that helped reawaken the field. How did that come about?

M. F. We were inspired by the work of the prematurely deceased Russian mathematician Koteljanskij. We even spoke about matrices of class K to honor him. We considered our seminal paper as a survey paper, and were surprised by the response. In fact, the notion of P-matrices began there.

J. S. You spent much of your career at the Czechoslovak Academy of Sciences, what roles and responsibilities did you have there?

M. F. Altogether, I spent more than 50 years there. (Since Czechoslovakia split apart, it has been called the Academy of the Czech Republic.) Until 1989, it was, on the one hand, an asylum for politically questionable mathematicians, and on the other hand, a place on which the highest political authorities focused their attentions. Most of the time, I was head of a small department that concentrated on numerical analysis, logic and graph theory. We had productivity plans to fulfill, and I considered

an important part of my task to protect people in the department from political pressure of the authorities.

J. S. Among the many papers that you have written, are there particular results of which you are fondest?

M. F. Although I had the most success with M-matrices, algebraic connectivity and, recently, companion matrices, I like most the following easily described result. Color the edges of an n-simplex red, blue, or white according to whether the opposite dihedral angle in the simplex is acute, obtuse, or right. Characterize all possible colorings. The answer is that such a coloring is possible if and only if the set of red edges connects all vertices of the simplex.

J. S. What areas of matrix theory do you currently find most interesting?

M. F. Totally positive matrices.

J. S. Any additional thoughts that you wish to share?

M. F. In addition to general advice such as don't be lazy and preserve your physical health, I think that young people should try to be really good in two fields, such as mathematics and biology, or in (at least) two parts of mathematics, one theoretical and one applicable. One should have imagination, even crazy ideas, but also technical skill. In mathematics, one usually tries to generalize, but this should not mean simply thinning the hypotheses of a previous result. When presenting a mathematical result, one should give a proof and not just try to convince the audience about its correctness by using too many words. In the old times, an ideal mathematical paper was such that no word was superfluous. Nowadays, one is expected to use what is probably a better approach for the reader – explaining the idea of the proof before giving the proof itself. Mila claimed that good mathematical results are usually also aesthetic. Finally, one should support mathematical olympiads and similar competitions for high school students; successful participants will better resist the seduction of easier earnings elsewhere.

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