POLISH APPLIED MATHEMATICIANS IN USA TODAY

Leszek Demkowicz

ICES, The University of Texas at Austin

I have to admit that I was a bit surprised when I was asked to prepare an overview on the subject. I am only a 50 or less percent mathematician by education, and my appointment is in a Department of Aerospace Engineering ad Engineering Mechanics[1]. On the other side, I have spent the last 24 years helping to build an interdisciplinary Institute for *Computational Engineering and Sciences (ICES)* at the University of Texas at Austin, and a graduate program in *Computational Science, Engineering and Mathematics (CSEM)* housed in the Institute (circa 80 Ph.D. students). When I have to define myself, I use the term *computational scientist* and *numerical analyst*, my work involves building models (typically described by systems of Partial Differential Equations (PDEs)), analyzing their well-posedness, constructing discretizations and analyzing convergence, writing software and, finally, solving challenging application problems. The Institute and the graduate program is based on a closed collaboration of engineers and scientists representing multiple disciplines (physics, astronomy, chemistry, biology, medicine (!)), mathematicians, computer scientists, software engineers. We do have our own specialties, but we do need to learn a little bit of all these subjects as well. The boundaries between different fields have become blurred. It is increasingly the subject of our research, and not our departmental affiliation that defines our disciplines.

So the very first question was *how to identify and find Polish colleagues doing applicable mathematics in US today ?* Notice that I have not used the term *applied* by *applicable* to extend the traditional boundaries of "useful" mathematics. For better of worse, I have based my presentation on two sources of information. The first one is a list of *Eminent Scientists of Polish Origin and Ancestry* maintained by the Kościuszko Foundation, see:

<div align="center">https://www.thekf.org/kf/programs/eminentscientists</div>

The second was the *MathSciNet* (Mathematical Reviews) data base maintained by the American Mathematical Society, see:

<div align="center">http://www.ams.org/mathscinet</div>

MathSciNet provides short reviews of papers containing math (usually identified by journals) as well as the total number of (reviewed math) papers co-authored by individuals and a total number of *MathSciNet* citations. I emphasize that authors do not necessary hold positions in math departments, their appointments may be in any departments and, as a matter of fact, not even universities but also research labs etc.

With the help of *MathSciNet* data base and a few private communications, I have been able to compile Table 1. I have neglected a large number of colleagues with a small number of papers and/or citations.

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[1]I do have a courtesy appointment in the Math Dept., though.

Name	Department	Institution	papers/citations
Blawzdziewicz, Jerzy	Mechanical Engineering	Texas Tech University	19/38
Bogacki, Przemyslaw	Mathematics and Statistics	Old Dominion University	8/30
Charatonik, Wlodzimierz J.	Mathematics	Missouri Institute of Science and Tech.	111/372
Chrobak, Marek	Computer Science and Engineering	University of California at Riverside	135/575
Ciesielski, Krzysztof Chris	Mathematics	West Virginia University	118/369
Ciesielski, Maciej	Electrical and Computer Engineering	University of Massachusetts	10/40
Demkowicz, Leszek F.	Aerospace Eng. and Eng. Mechanics	University of Texas at Austin	143/1923
Domaradzki, J. Andrzej	Aerospace and Mechanical Eng.	University of South California at LA	16/70
Ehrenfeucht, Andrzej	Computer Science	University of Colorado at Boulder	231/1087
Ełżanowski, Marek	Mathematics	Portland State University	27/33
Filus, Lidia	Mathematics	Northeastern Illinois University	14/7
Grzymala-Busse, Jerzy	Electrical Engineering	University of Kansas	38/35
Hajłasz, Piotr	Mathematics	University of Pittsburgh	62/1728
Imielinski, Tomasz	Computer Science	Rutgers University	14/32
Iwaniec, Henryk	Mathematics	Rutgers University	154/4069
Iwaniec, Tadeusz	Mathematics	Syracuse University	136/3289
Jarecki, Stanislaw	Information and Computer Sciences	University of California at Irvine	24/65
Kapuscinski, Roman	Technology and Operations	University of Michigan	7/27
Kimmel, Marek	Statistics	Rice University	73/256
Kocik, Jerzy	Mathematics	Southern Illinois University	16/25
Kowalik Lukasz	Chemistry	Stanford	46/154
Kuperberg, Greg	Mathematics	University of California at Davis	61/958
Kuperberg, Krystyna M.	Mathematics	Auburn University	37/112
Kuperberg, Wlodzimierz	Mathematics	Auburn University	15/173
Lasiecka, Irena	Mathematical Sciences	University of Virginia at Charlottesville	390/5648
Lewicka, Marta	Mathematics	University of Pittsburgh	48/324
Lubotorski, Adam	Mathematics	Syracuse University	18/140
Manitius, Andrzej	Telecommunications	George Mason University	31/231
Marszalek, Wieslaw	Mathematics	Rutgers University	30/54
Mycielski, Jan	Mathematics	University of Colorado at Boulder	149/548
Nitecki, Zbigniew	Mathematics	Tufts University	44/477
Peszynska, Malgorzata	Mathematics	Oregon State University	26/104
Pilch, Krzysztof	Physics	University of Southern California	74/208
Radziszowski, Stanislaw	Computer Science	Rochester Institute of Technology	72/409
Rempala, Grzegorz A	Biostatistics	The Ohio State University	49/163
Rosinski, Jan	Mathematics	University of Tennessee	86/962
Rucinski, Andrzej	Electrical and Computer Engineering	University of New Hampshire	116/2014
Ruszczynski, Andrzej	Management Science	Rutgers University	112/1300
Soltys, Michael	Computer Science	California State University	23/26
Szpankowski, B. Wojciech	Computer Science	Purdue University	166/875
Taylor, Tomasz	Physics	Northeastern University	54/80
Weyman, Jerzy	Mathematics	Northeastern University	87/1294
Wilczek, Frank	Physics	Massachusetts Institute of Technology	85/365
Wocjan, Pawel	Computer Science	University of Central Florida	36/87
Wozniakowski, Henryk	Computer Science	Columbia University	201/2469
Ziolkowski, Richard W.	Electrical and Computer Engineering	University of Arizona	38/54

Table 1: Polish contributors to Mathematics in US today. A preliminary list.

Name	Department	Institution	papers/citations
Lasiecka, Irena	Mathematical Sciences	University of Virginia at Charlottesville	390/5648
Iwaniec, Henryk	Mathematics	Rutgers University	154/4069
Iwaniec, Tadeusz	Mathematics	Syracuse University	136/3289
Rucinski, Andrzej	Electrical and Computer Engineering	University of New Hampshire	116/2014
Wozniakowski, Henryk	Computer Science	Columbia University	201/2469
Demkowicz, Leszek F.	Aerospace Eng. and Eng. Mechanics	University of Texas at Austin	143/1923
Hajłasz, Piotr	Mathematics	University of Pittsburgh	62/1728
Ruszczynski, Andrzej	Management Science	Rutgers University	112/1300
Weyman, Jerzy	Mathematics	Northeastern University	87/1294
Ehrenfeucht, Andrzej	Computer Science	University of Colorado at Boulder	231/1087

Table 2: Colleagues with more than 1000 citations.

A subset of colleagues with more than 1000 citations is shown in Table 2 and, in my presentation at the Congress, I will provide a short overview of their work and accomplishments. In this group, Professors Henryk Iwaniec, Piotr Hajłasz and Jerzy Weymann definitely work on most theorerical subjects perhaps distant from immediate applications. With a danger of a little overlap with other presentations at the Congress, I will talk about their work as well.

Is there any conclusions and observations, I can draw at this point? First of all, I reiterate the observation that the boundaries of mathematics have significantly expanded and become blurred. The emergence of Computational Science and Engineering including Computational Mathematics [1] has already dramatically modified funding mechanisms for mathematical research, see e.g. the web page of Division of Mathematical Sciences of National Science Foundation,

https://www.nsf.gov/div/index.jsp?div=DMS

With computer simulations, we are not longer expected to provide qualitative but also quantitative results. Understanding modeling, discretization techniques, data collection and Uncertainty Quantification (UQ), optimization and control for *large scale* simulations has been pushing classical boundaries of mathematics for a long time. New research needs require new education models integrating mathematics and statistics with other fields. The classical academic structure based on colleges and departments is evolving and it may soon become obsolete.

At the same time, I firmly believe in well defined characteristics that separate mathematicians from the rest of the crowd: search for logical (in)consistencies, systematic approach, clear specification of assumptions, "confession of mathematical gaps" and, of course, love for mathematical abstraction and structure.

Concerning the Polish Americans math community, we are not large but definitely visible. The legends of Antoni Zygmund, Alfred Tarski, Stanislaw Ulam, Mark Kac and others are very alive in US math communities and Polish mathematicians can frequently be found in US Academia.

Concerning the situation at home, I am still waiting for a new Zygmund Janiszewki who recognized

limited possibilities of a small country the Poland has been, and pushed for a coordinated funding and development in selected mathematical fields that led to Stefan Banach and creation of Functional Analysis. With great traditions in mathematics, mechanics, computer science and software engineering, *Computational Mathematics* should be a Polish specialty.

References

[1] Ulrich Rüde, Karen Willcox, Lois Curfman McInnes, Hans De Sterck, George Biros, Hans Bungartz, James Corones, Evin Cramer, James Crowley, Omar Ghattas, Max Gunzburger, Michael Hanke, Robert Harrison, Michael Heroux, Jan Hesthaven, Peter Jimack, Chris Johnson, Kirk E. Jordan, David E. Keyes, Rolf Krause, Vipin Kumar, Stefan Mayer, Juan Meza, Knut Martin Mrken, J. Tinsley Oden, Linda Petzold, Padma Raghavan, Suzanne M. Shontz, Anne Trefethen, Peter Turner, Vladimir Voevodin, Barbara Wohlmuth, and Carol S. Woodward. Research and education in computational science and engineering. *SIAM Review*, July 2017. submitted,arXiv:1610.02608 [cs.CE].

Dr. Leszek F. Demkowicz is Assistant Director of the Institute for Computational Engineering and Sciences (ICES) and holder of W. A. "Tex" Moncrief, Jr. Chair in Computational Engineering and Sciences II at ICES. He is a Professor in the Dept. of Aerospace Engineering and Engineering Mechanics and a Professor in the Dept. of Mathematics, at the University of Texas at Austin. He has a M.S. in mathematics from Jagiellonian University, and M.S., Ph.D. and Sc.D. degrees in mechanics from Politechnika Krakowska (PK), Poland. Prior to joining the University of Texas faculty, he held various positions at PK. In 1991, he helped to establish Polish Association for Computational Mechanics (PACM) and served as its first president.

Dr. Demkowicz authored a monograph on adaptive methods (in Polish, 1986), co-authored with J.T. Oden a textbook on Functional Analysis (CRS Press, 1996, second edition - 2010, third edition - 2017) and a two volume monograph on "Computing with hp-Adaptive Finite Elements" (Chapman & Hall/CRC, 2006,2007) . Dr. Demkowicz has also authored and co-authored over 200 journal articles, conference proceedings, book chapters and technical reports in the general area of computational mathematics and mechanics. His work and scientific interests span across numerical analysis, adaptive finite element methods, wave propagation problems, including acoustics, elastodynamics and electromagnetics, and CFD. In the last five years his work focused mainly on the Discontinious Petrov Galerkin Method, co-invented with Jay Gopalakrishnan from Portland State University. His recent research has been sponsored by NSF, Air Force, Navy, Army, DOE and Sandia Labs.

Since 2012, he has been the Editor-in-Chief of Computers and Mathematics with Applications (Elsevier). He also serves on the editorial board of 11 international journals. He is currently the President of US Association for Computational Mechanics. He has graduated 17 Ph.D. and 7 M.S. students, and is currently supervising 6 Ph.D. students. For his research on higher order methods, he has been awarded Zienkiewicz Medal by PACM, Computational Science Award by USACM, ICES Distinguished Research Award, and the Computational Mechanics Award by IACM in 2014. He is a Fellow of both IACM and USACM and an honorary member of PACM. Since 2014, he is a foreign member of Polish Academy of Arts and Sciences.