Inspiring the World Beyond the Theory of Gearing

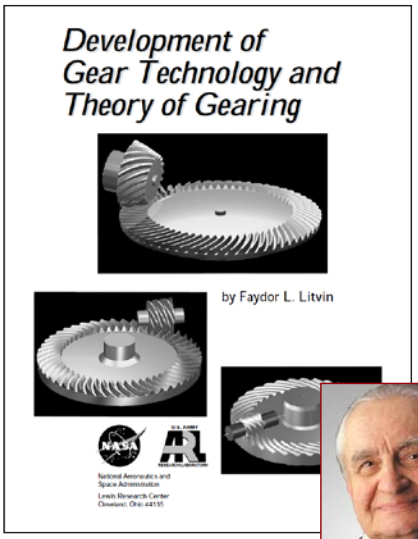
Celebrating Dr. Faydor Litvin: Remarkable Scientist, Dedicated Mentor, Continuing Inspiration

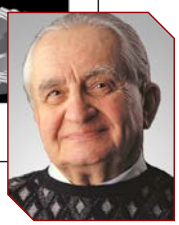
The first time that I had heard of Dr. Faydor Litvin was when I was working on my master's degree thesis about the development of a new type of helical gear drive at a university in China. During that time, my advisor, Professor Zuodu Zhang, shared with me his admiration for Dr. Litvin and how his academic career and research on gear geometries benefited significantly from Litvin's works. Professor Zhang introduced to me a Chinese version of the *Theory of Gearing*, a renowned piece of Dr. Litvin's work, and said to me, "I have long been hoping to meet Dr. Litvin since I read his works in Russian, and although I may not be able to make it in my lifetime, I do hope that you could be his Ph.D. student someday." Since that particular moment, a dream was formed in my mind.

Several years later, my dream came true; Dr. Litvin generously supported my Ph.D. candidacy and became my advisor at the University of Illinois at Chicago (UIC). A year later, as I became fully involved in multiple research projects at the UIC Gear Research Center, I was informed that Professor Zhang had become very sick after fighting cancer for several years. Having heard the news, I wanted to do something for Professor Zhang. After pondering for a while, I came up with an idea and went to Professor Litvin's office, where I told him about Professor Zhang's story and his current situation. I hesitated to ask whether professor Litvin could present professor Zhang with a copy of his book, *Development of Gear Technology and Theory of Gearing*, published by NASA, and autograph it as well. To my surprise, right after I finished my story, Professor Litvin said to me, "Qi, I am touched by your story about your former professor and proud of you for your kindness and thoughtful idea. I am very happy to do this and please also send him my best wishes and a (quick) recovery." In addition, Professor Litvin wrote a personalized note addressed to professor Zhang and proposed to take a picture with me and requested that I send the book together with the picture to Professor Zhang. I felt very thankful and overwhelmed with joy at that moment, knowing just how happy this would make my former professor in China.

In 2010, I traveled back to China and visited Professor Zhang's family but was told upon arrival that he had just passed away. His wife greeted me while tears quickly filled up in her eyes as she recalled just how happy and honored her husband had felt when he received the autographed book and the picture. She recalled that whenever her husband read the book, she could see a feeling of joy and happiness on his face. Reading the book gave him renewed optimism and a feeling of satisfaction, as well as an invisible power to fight the cancer, Mrs. Zhang added. She also told me that her husband had been keeping the book and the picture beside his pillow all the time. Mrs. Zhang requested that I convey her strong feelings of gratitude to Dr. Litvin and thank him deeply for providing her husband with such a wonderful spiritual medication that had helped him courageously fight his illness for so many years.

The power beyond Dr. Litvin's theory of gearing is truly immeasurable and remains an ongoing source of inspiration, touching the personal lives of many gear professionals all over the world. Professor Litvin is not only a remarkable scientist and a dedicated mentor who has advised hundreds of graduate students and visiting scholars from over the world. He is also a great father who is always caring and willing to help his students and their families in their course of seeking professional fulfillment.





Dr. Faydor Litvin turned 100 years old in January. Some of his long-time friends, colleagues and collaborators have taken this opportunity to reflect on his career, thank him for his contributions and wish him congratulations.

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>
> **Qi Fan, Ph.D.**

It is my lifelong honor to have been a Ph.D. student of Dr. Litvin's; without his training and guidance, I would not have had the opportunity to realize my career goal and to be presented with the opportunity to work at The Gleason Works as a gear theoretician.

I would like to take this moment to say Happy 100th Birthday to Professor Litvin and best wishes to him and his entire family.

And lastly, "Professor, thank you very much for everything, and I sincerely wish you continued great health and happiness!"

Qi Fan, Ph.D.

With Dr. Litvin's strong backing of **Qi Fan**'s Ph.D. candidacy, Fan gained admittance in 2000 to the University of Illinois at Chicago (UIC) and Litvin's renowned Gear Research Center. Since 2001 Dr. Fan has worked as Senior Gear Theoretician—Research and Development—for The Gleason Works. Fan is also an associate editor for the ASME Journal of Mechanical Design and a member of the Technical Committee of the ASME Power Transmission and Gearing Committee. He has authored 26 technical papers.

Dr. Faydor Litvin came to the United States in 1978 after a long teaching career in Russia and his retirement as Department Head and Professor of Mechanical Engineering from the Leningrad Institute of Precision of Mechanics and Optics. Upon coming to this country, Dr. Litvin then embarked upon a second career starting in 1979 at the University of Illinois at Chicago (UIC). His second career spanned in excess of 30 years.

During these 30 years, Dr. Litvin had a continual working relationship with NASA, the U.S. Army, and the U.S. rotorcraft industry through the funding of university research grants and contracts. His close working relationship with the U.S. government and the aerospace industry resulted in a multitude of reference publications, contractor reports, conference papers, presentations, and refereed journal articles.

As an educator, Dr. Litvin and the program that he ran from UIC resulted in many specialized gear geometry experts (Ph.D. students) that now work in the gear manufacturing field here and around the world. His personal attention to his students—both foreign and American—was as if each and every one were family members, and he closely mentored them to produce high-quality graduate level research.

> His impact on the gearing world has been substantial.
> **Robert F. Handschuh**

Dr. Litvin also has left his mark in several areas from his dedicated efforts to move the gear geometry field forward. During his government and private industry funding years, all types of gears as used in aerospace drive systems were studied from the gear geometry point of view. His impact on the gearing world has been substantial.

Two of his important contributions came on spiral bevel and face gears. Both of these gear types are utilized in rotorcraft main transmissions to turn the corner from the horizontal gas turbine engines to the vertical rotor shaft. His spiral bevel gear work led to low-noise, high-power gearing through the careful consideration of the gear tooth machine tool settings during manufacture to produce gears with low transmission errors. This practice has been accepted and implemented in various companies in the aerospace gearing business.

The second important aerospace contribution has to do with the development of face gear grinding technology. An Army-funded program produced a design utilizing this type of gearing that resulted in a substantial overall drive system weight advantage. The problem was that the manufacturing technology of this type of gear was stuck in the 1950s. A method had to be developed to grind the gears after carburization. A manufacturing technique was developed by Dr. Litvin and his Ph.D. students to provide the high-accuracy gearing necessary for rotorcraft drive systems. This technology has found its way into the upgraded attack helicopter used by the U.S. Army.

The U.S. gear manufacturing industry is a better place due to the dedicated work of Dr. Faydor Litvin.

A true patriot of his adopted country.

Robert F. Handschuh

Dr. Robert Handschuh is a 30-year NASA veteran with invaluable experience in DOD rotorcraft drive system analysis and experimental methods. He is credited with successfully developing many experimental research test facilities as Team Leader for the Drive Systems Tribology & Mechanical Components Branch at NASA Glenn Research Center in Cleveland, Ohio, and has conducted testing in areas such as spiral bevel gears and face gears; high-speed, helical gear trains; planetary gear trains; single-tooth-bending fatigue; and high-speed gear windage.