



## A Profile of Excellence and Success



## Moshe (Shefi) Shpitalni: A Scientist and a Gentleman



Prof. Moshe (Shefi) Shpitalni's wide-ranging international activities on the forefront of science and technology along with his outstanding accomplishments in promoting science, manufacturing technologies and CAD/CAM in academia and industry have led him to believe that scientific collaboration is the ultimate means to bridge controversies and differences and to bring people together. For life is the sum total of the challenges and the people one encounters along the way.

From his home in the small town of Rehovoth in the late 1940s and 1950s, a place where everyone knew everyone, Shefi gained an understanding of the importance of contributing to the state and learned to behave courteously and respectfully toward every individual. He already knew he would become an engineer when he grew up and had the confidence to follow his own path, with the values of friendship, openness, empathy and morality lighting his way forward.

Shefi completed his bachelor's and master's degrees in the Faculty of Mechanical Engineering at the Technion. During his doctoral studies in the faculty, he and two partners founded Isralaser, a company in the industrial zone of Migdal Haemek. In 1983 he joined the Faculty of Mechanical Engineering and established the Laboratory for Computer Graphics and CAD (today the Laboratory for CAD and

Lifecycle Engineering), which he headed until his retirement in October 2015.

Throughout his exciting professional career, Shefi's accomplishments won him a great deal of respect and admiration. He was appointed a fellow of the CIRP, the SME and the ASME and held the Schlesinger Chair in Manufacturing Systems in the Faculty of Mechanical Engineering. He was awarded an honorary Advisory Professorship at Shanghai Jio Tong University and was the recipient of the German Technion Society Prize (GTS) and the WBMiZ Medal from Politechnika Poznanska, Poland. He held senior positions in The International Academy for Production Engineering (CIRP), sat on scientific expert committees of the European Union and the German Research Foundation (DFG) and served on the presidential advisory committee of KAIST (Korea Advanced Institute of Science and Technology). During his academic career, he advised more than 40 graduate students, published over 140 articles in professional journals and initiated pioneering developments that have led to improvements in manufacturing methods and systems. In 2013 he became the first Israeli to be awarded the prestigious SME Sargent Progress Award for manufacturing engineers. In addition, in the many positions he has held in the Faculty of Mechanical Engineering and at the Technion he left a significant mark, in particular when he served as Dean of the Technion Graduate School from 2006 through 2011. Indeed, his career is one of excellence and success. **A special profile of excellence and success.**

Shefi was born in Rehovoth in 1947. His father Menachem was a Zionist who emigrated from Poland after finishing high school. His mother Chaya (nee Harlap) was born in pre-state Palestine and her family was among the founders of the city of Rehovoth. Shefi's life began with a traumatic experience, when a bomb from an Egyptian plane seriously damaged the family home during the War of Independence. Shefi's father was an attorney who educated Shefi from a young age that he should become an engineer who would build and develop the land. The father claimed the country had enough attorneys and that lawyers were not productive. Shefi's mother, who had been forced to abandon her accounting studies because her family did not have enough money to pay her tuition, made sure to open savings accounts for Shefi and his younger brother Efraim (who later became an attorney) so they could learn a profession when they grew up.

"My parents were warm people who pushed us to excel in whatever we did," Shefi recalls. "And because of my father's attitude I already knew at age 5 that I would be an engineer when I grew up. I studied at the Smilenski Elementary School, belonged to the Maccabi Hatzair (Young Maccabi) youth movement, was a short-distance runner and played handball for Maccabi Rehovoth. My mother also went to the Smilenski school and because of the atmosphere at the time in Rehovoth where everyone knew everyone, I knew that everything I did at school would somehow get back to my mother. From a young age I remember myself surrounded by friends, and because we were educated on the value of friendship I still have many friends today that date back to my kindergarten days. When I finished elementary school, I went on to the municipal high school in Rehovoth, where we had a special excellence program in mathematics with the Weizman Institute. As a student I was very good in math and physics and average in all the other subjects. My friends and I put great emphasis on after school social activities, and every day after school we would hang out outside the café in the center of Rehovoth. On Friday nights we went to parties at private homes, on Saturday nights we went to the movies, and when we wanted to eat pizza we went to Tel Aviv. At that café I also met Bella, who became my wife and my life partner. I finished high school in 1965 together with many friends. We all joined the IDF in November of that year as part of a group originally intended to serve two years and two months of compulsory service. That period was extended to two and a half years and toward the end of our service again extended to three years. After my discharge I took the entrance exams and began studying at the Technion. At that time, no one thought about travelling abroad after the army. I did not apply to any other institution of higher learning because the Technion was the leader in training engineers. I chose to study in the Faculty of Mechanical Engineering rather than the Faculty of Electrical Engineering mainly because my excellent math and physics teacher in high school, Mr. Chabaza, kept getting electric shocks each time he demonstrated anything for us in class and I decided to spare myself that experience."

"I began studying for my degree in 1968," Shefi goes on, "and I rented a room from a family in Neve Shaanan. In my first year I took 47 hours a week, like in high school, but I soon learned that this was not so bad and I also found time for social activities. At the time there was no air conditioning at the Technion, and except for Churchill Hall smoking was allowed in all the classrooms, which were often permeated with cigarette smoke. The office of the dean and the faculty secretaries were in the Senate building, and the German Jewish attention to detail and punctuality that dominated the faculty promoted a harsh and uncompromising attitude toward students and their academic obligations. I remember that for one of our projects the late Prof. Kurt Levy asked us to submit drawings of the plans for a factory and I was a bit late in preparing the drawings. When I went to submit my project, Prof. Levy said to me: 'Mr. Shpitalni, the factory has burned down. Your drawings are no longer needed.' Only after weeks of 'torture' was the professor willing to accept my drawings." At the end of Shefi's third year of studies Bella was discharged from the army and the two got married. They have three children—their daughter Or (a doctoral student at Haifa University), their son Amir (an entrepreneur and manages start-ups) and their daughter Ophir (a psychology student at the IDC in Herzilya)—and five grandsons: Omri, Gilad, Ilai, Nadav and Matan.

"Towards the end of my bachelor's degree studies," Shefi continues, "I took courses in electricity, computers and numerical systems, and I began thinking about continuing for graduate studies, which I began in 1972 immediately after completing my bachelor's degree. I did my master's degree in the Center for Manufacturing Systems under the supervision of Dr. Yoram Koren in the field of numerical control (NC) of light machinery. The task was to build a numerical control system for milling when at the time the entire system was built from hardware. When Dr. Koren left for his post-doctoral studies, Dr. Braun and Prof. Lenz continued as my supervisors. Toward the end of my studies the Center received a request from the factory at Kibbutz Merchavia to develop a system for producing

holes in irrigation pipes. As was customary at that time, we all devoted ourselves to this development, and I was responsible for developing the control system. In effect the demand was to develop a system for producing the holes using laser pulses. We built an opto-mechanical system for producing holes in irrigation pipes, first in an offline mode (the pipe is static while the hole is punched) and then another system that worked online whereby the holes are punched as the pipe leaves the extruder. The work on developing this system, which was my first "industrial" implementation of what I had learned in theory, captivated me and I devoted all my time to it. This somewhat postponed completion of my degree but brought me a great deal of joy and satisfaction and led to an influx of money to the Center. Eventually I went back to working on my master's degree, which I completed cum laude. At that point I very much wanted to use my knowledge and develop an industrial plant, but after some moderate pressure from Prof. Lenz I began working on my doctorate in 1975 under his supervision, on the topic of 'Adaptive Control of the Electrochemical Grinding Process.' I was seemingly immersed in my doctoral studies and my way forward seemed to be a given. Nevertheless, a combination of an ongoing inner urge to find expression for my newfound abilities and serious doubts about continuing with my doctorate led me to take some time off in 1977, when I founded a company called Isralaser in the industrial zone of Migdal Haemek, together with another programmer, practical engineer and a secretary who came once a week."

Shefi continues talking about the company. "The company's services were based on a special optical table that we developed using advanced CNC/DNC control. We developed this based on a commercial control system. The company was the first in Israel to offer cutting services using laser beams. The main idea of the company was that we would take orders to develop opto-mechanical systems for laser applications while insuring sources of income by giving laser-cutting services to local industries. The system we developed and the services provided by Isralaser aroused a great deal of interest in Israel and abroad, and scientists from across the country came to see the miracle: the strongest laser in Israel. At the same time, the meagre infrastructure at our disposal and the geographic location at the country's periphery made it difficult for us to preserve the successful momentum. Requests came in from abroad to develop similar systems, but considering that our major communication channel was a public telephone on the road between Migdal Haemek and Tivon and that even this did not work most of the time, the effort required to realize Isralaser's potential for growth was enormous. In 1979 I became ill, and as a result two things happened. I decided to sell Isralaser to Kibbutz Re'im, where the factory is still successfully running today, and Prof. Lenz suggested I return to the Technion to complete my doctorate. And that's what happened."

In the summer of 1980 after completing his doctorate, Shefi received an excellent offer from Rensselaer Polytechnic Institute in upstate New York to teach a course on numerical control and to work at the institute's Center for Manufacturing. Shefi recalls: "The position I was offered came with a full professor's salary in a field in which I wanted to concentrate and at the one of the best schools in the United States at the time for computer graphics and computer aided design. I embraced the offer wholeheartedly. Of course moving to the United States, a foreign country, with two small children was not easy, but the family quickly made arrangements and I rapidly became well integrated at the university. One of my first projects at Rensselaer was to write a proposal for a competitive grant offered by the Boeing airplane manufacturer on the topic of numerical control program verification. Our proposal competed with proposals from leading universities, and apparently because we did not make outlandish promises we were awarded the grant. Thus I found myself frequently traveling across the continent to Seattle to work on this project, which was deemed a big success by the company's senior professionals. This and my other teaching and research activities won a great deal of admiration at Rensselaer. The senior faculty of the School of Engineering led by the dean, Prof. Ling, one of the most intelligent people I have ever met, encouraged me to take a long-term position as a professor at the university."

"At the same time," Shefi continues, "the Technion's administrative committee decided there was a need to establish a laboratory for computer graphics and CAD at the Technion. Thus a delegation from the Technion came to visit me at Rensselaer, headed by the Technion Executive Vice President for Research and Development, who at the end of the visit informed me that if I were to return to the Technion this laboratory would be set up in the Faculty of Mechanical Engineering. The next morning I received an urgent telephone call from Prof. Lenz asking me to send all the paperwork to the Technion as soon as possible. And that's what I did, though after that I heard nothing from the Technion. On the eve of the outbreak of the First Lebanon War I came to Israel for the sake of a project I was leading for Elron. The project involved conceptual design of a new product: a graphical system for

interactive programming of machine tools based upon the APT language. The challenge involved in this project was to transform the infinite geometry used in APT to finite geometry suitable for graphic display. During this trip no one from the Technion approached me, so I returned to the United States. Eventually, when I had already received the contract to continue my employment at Rensselaer, I received a short and terse telegram from the Technion announcing that 'for reasons we cannot explain we request that you return immediately to the Technion.' So in July 1983 I left Rensselaer. As a family we had an amazing time in the United States. The children enjoyed themselves and learned English and skiing. We traveled a great deal and made new friends."

"Returning to the Technion was not so simple," Shefi recalls. "I set up the Laboratory for Computer Graphics and CAD in the basement of the Manufacturing Systems building. The lab's activities centered on a large computer from the CDC company that we brought from the Israel Military Industries and connected to the faculties of Architecture, Mechanical Engineering and Aeronautics. In the mid-1980s there was a major demand at the Technion for courses and research in the fields of computerized drafting, graphics and computational geometry and as a result we were given space for the lab in the Lady Davis building. Along with my academic work in teaching and research, during that time I worked in industry evaluating CAD/CAM systems for Rafael, aviation CAD/CAM systems for Cyclone Aviation Products Ltd. and numerical control systems for Conlog Control Ltd. as well as system planning for Cimatron. In the summer of 1987 my family and I spent a sabbatical year at the University of California in Santa Barbara (UCSB), where I was invited to set up a CAD/CAM laboratory. That wonderful year served as a welcome break before returning to the pressures at the Technion. Soon after my return to the Technion, a visitor from Holland who happened to be at the Technion paid an unexpected visit to the laboratory. The visitor was the owner of Sorba, a Dutch company that manufactured sheet metal products. The wonderful chemistry that immediately developed between us led to the signing of a contract with Sorba and to excellent cooperation, which reached its height in 1989-1990 when the laboratory completed the development of Origami: a parametric CAD/CAM system for cutting and bending sheet metal products, the world's leading system in this field at the time. The Japanese company Amada monitored the development of Origami and our developing relationship with the Dutch company from afar and ultimately purchased the software from Sorba. Amada continued development at the Technion for an additional two years, and the income from this enabled us to continue to build and develop the lab. The lab blossomed during the late 1980s and early 1990s, as evidenced by a flow of excellent graduate students who sought to do their degrees under my supervision in the fields of manufacturing systems, planning and geometric modeling of products and systems and the use of geometric logic and artificial intelligence to handle design and manufacturing problems."

"Around that time," Shefi recalls, "Prof. Lenz informed me of the possibility of receiving funding from the Stiftung Volkswagenwerk to work in collaboration with the IWF Technical University of Berlin. Because of the education I received at home, I deliberated a great deal about whether to enter into collaboration with Germany. When I consulted with my father he told me that if it serves the Technion and would lead to developing the state of Israel, I should do it. And that's what happened. The trip to Germany was very emotional for me. In the ensuing years I developed strong collaborative ties not only with the university in Berlin but with other leading organizations as well, among them the German Research Foundation (DFG), where I served as an expert to promote centers of excellence and doctoral programs in the fields of manufacturing systems and CAD/CAM. As part of my cooperation with Germany, I was chosen to head the Minerva Schlesinger Laboratory for Life Cycle Engineering at the Technion for 14 years. I also received a special appointment by the Senate of Berlin to the Georg Schlesinger Prize Committee and after Prof. Lenz's retirement was appointed Schlesinger Chair in Manufacturing Systems, a position I held until my retirement. My excellent relationship with colleagues in Germany, which became stronger over the years as we worked together on a variety of international teaching and research activities, again proved to me that scientific cooperation can bridge controversies and differences and lead to strong interpersonal connections. I have fully adopted this narrative and I truly believe in it. I promoted this through the Minerva center, later motivating me as Dean of the Technion Graduate School to initiate and sign agreements for joint doctoral degrees with leading institutions abroad. Perhaps it is symbolic that a doctoral student from the University of Bremen in Germany recently did graduate work in my lab."

In the second half of the 1990s Shefi served in a number of positions at the Technion and abroad, some on international professional advisory boards. During that same period he also spent short periods as a visiting

professor at the Technical University of Denmark (DTU) and at the University of Tokyo in Japan. Together with his hosts at these two universities, he developed the concept of selling services rather than products using programs based upon recycling and product life cycle. This approach was later adopted by the European Union's NMP research program. During the 2000s Shefi began taking a more senior role in international settings abroad and at the Technion. Among these he was a visiting professor at the University of Michigan in Ann Arbor and served as Editor in Chief and referee for international professional journals. He also served on the advisory board of EU research and excellence programs, committees of the International Academy for Production Engineering (CIRP) and the Schlesinger Prize committee. At the Technion Shefi served as Associate Dean for Undergraduate Studies, a member of the Senate, a member of the coordinating committee, head of the J.W. Ullmann Center for Manufacturing Systems and Robotics and other positions as well. From 2004 Shefi began to amass awards and recognition for his longstanding activities to promote science and manufacturing technologies. Among these honors are his appointment as a fellow of the International Academy for Production Engineering (CIRP), the American Society of Mechanical Engineers (ASME) and the Society of Manufacturing Engineers (SME). He also was awarded an honorary Advisory Professorship at Shanghai Jiao Tong University, the German Technion Society Prize (GTS) and the WBMiZ Medal from Politechnika Poznanska, Poland.

In 2006 Shefi was appointed Dean of the Technion Graduate School, a position he held through 2011. While he was dean the number of doctoral students at the Technion increased by 50%, and construction of the Graduate Students Village with 215 housing units as part of the Technion's plans for future generations, was completed. Among the certificates and medals decorating the walls of Shefi's office, the following certificate stands out: "Prof. Moshe Shpitalni of the Technion Graduate School is granted the degree of Best Dean in the World." All the graduate school employees signed this certificate, testifying to Shefi's affable way of conducting himself and his quiet and calm ability to succeed through an attitude that is generous, egalitarian, warm and respectful to everyone around him. While serving as the Dean of the Graduate School, Shefi was appointed to the directory board of the Virtual Research Lab for a Knowledge Community in Production (VRL-KCiP) Network of Excellence, European Union 6<sup>th</sup> Framework Programme. Later he was appointed a member of the Directory Board and Vice President for Research of the European Union's EMIRacle (European Manufacturing and Innovation Research Association, a cluster leading excellence) and a member of the presidential advisory committee of KAIST (South Korea's most advanced technological institute).

During Shefi's 32 years in the Faculty of Mechanical Engineering at the Technion, he published over 140 articles in professional journals and at conferences. He supervised more than 40 graduate students, among them Prof. Hod Lipson from Columbia University in New York, Prof. Anath Fisher who now heads the Technion Laboratory for CAD and Lifecycle Engineering, Prof. Gershon Elber of the Technion and many others who today hold key positions in academia and industry. He also served as editor in chief of the *International Journal for Manufacturing Science and Production* and co-editor of five additional journals. From 2012 until his retirement in 2015, Shefi served as chair of the Technion Autonomous Systems Graduate studies Program and as Deputy Executive Vice President for Academic Affairs, a position he continues to hold today. For his extraordinary achievements over the years in promoting manufacturing systems and manufacturing methods and developing technological methods for improving manufacturing, in 2013 he was awarded the prestigious Albert M. Sargent Progress Award of the Society of Manufacturing Engineers (SME). Shefi is the first Israeli to receive this award. Shefi sums up as follows: "The road to success opened up for me by doing research in fields that I loved, by investing all my efforts in work and achievement, by fully cooperating with partners with forward-looking ambitions and by maintaining professional ethics, keeping an open mind and keeping my eyes open. With all this and a little bit of luck thrown in, I have succeeded. I am pleased to have this opportunity to thank my colleagues in the Faculty of Mechanical Engineering and at the Technion for supporting, helping and encouraging me throughout my years at the Technion and I wish them every success in continuing to promote and support the Technion."

