20
YEARS

FIT BUT

20 YEARS OF FIT BUT

FACULTY OF INFORMATION TECHNOLOGY

<2022>

Brno University of Technology
Faculty of Information Technology
2022

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CONTENT

Already 20 years moving forward

2002 → 2022

A small change in a single digit, but a huge change in the world. No other area showcases this change as much as information technology. IT has brought the most significant changes to our world during these past decades – and we must point out, that most of the time, the changes are for the better. Try to count how many of the inventions that made your life in the last twenty years easier or better are related to IT in one way or another.

We believe it will be a majority of them. IT is one of the most dynamically developing fields, if not the most dynamic one. **The development of FIT BUT over the last 20 years was no less dynamic.** We can see this change everywhere. From the spaces used to hold classes through the IT field itself to co-operation with companies or the research performed at FIT BUT.

However, FIT does not change just itself, that would not be enough. We dare to say that by cultivating the compound at Božetěchova street, the faculty significantly altered the appearance of Královo Pole. That it provided many graduates with the knowledge and skills that have pushed their careers forward, and that it is thanks to them that South Moravia is becoming a knowledge-driven region.

Many things have happened over those 20 years and it is not possible to describe everything in a single publication. Yet at the same time, we would like to show you what the faculty is like today and what path led to its current state. We wish you a pleasant reading!

Your Faculty of Information Technology BUT

20 years of FIT in numbers

45 000

APPLICANTS

5 000

PUBLICATIONS

700+

RESEARCH PROJECTS

22 000

BOOKS AND OTHER PUBLICATIONS IN THE FACULTY LIBRARY

650

DEVELOPED PRODUCTS (34 PATENTS)

12 232 m²

TEACHING AREA (20 000 m² IN TOTAL)

20 000 000

DAYS IN IT AND TECHNOLOGICAL COMPANIES WORKED BY OUR STUDENTS AFTER GRADUATING

8 700

GRADUATES

FACULTY CAMPUS FROM

14TH CENTURY

10

LABORATORIES

FACULTY GROWS, VALUES REMAIN

Pavel Zemčík /
Dean of the Faculty
since 2016

For over 20 years, technology, creativity, education, research and innovations have been inextricably linked with the Faculty of Information Technology. Pavel Zemčík has served as the head of the faculty for the past six years. ***"20 years is an ideal time to recall the foundations of the faculty and to think about how we can further strengthen them in the future,"*** **he says.**

Is the faculty, as you see it today, the result of an evolution or rather a revolution?
I would say that it's certainly the result of an evolution. The people who work at the faculty embody FIT and the vast majority of them do a good job and are loyal to BUT. On top of that, most of the people who founded the faculty are still working there. Thanks to this, we are able to maintain good relations and stand up for the original values, such as correctness and openness.

What makes the faculty different today than it was 20 years ago?
The structure and focus are still the same and we maintained our outreach into many areas of IT with an emphasis on technology and hardware. But it goes without saying that the faculty is growing and evolving. We have updated our study programmes and, compared to 20 years ago, we have many more students and applicants. We have also managed to establish many valuable co-operations, whether with foreign or Czech universities, researchers or companies.

You have linked your entire professional career to the faculty you helped to found, you also studied at BUT. If you made your decision today, would you still go study at the Brno University of Technology?
Definitely. Apart from the reasons which convinced me back in 1984, when I started my studies, such as high-quality education, good equipment and leading experts, I would also have a number of new ones. It would be a great chance of finding employment after graduation, good life-long prospects regarding employment, but also the chance to participate in international exchange programmes or to take part in top quality research.

What is your current vision regarding FIT?
I wish it were a faculty educating ever more ingenious students, employing professional and helpful teachers and research workers achieving scientific results of ever-growing quality. The Faculty is widely recognised as a high-quality, solid and stable part of the Brno University of Technology; it would be great if we were able to increase the faculty's renown on a global scale both in terms of its academic results and its reputation and if it became an attractive partner for both pedagogical and research projects. Students of our faculty should be proud of their work and results and the overall faculty life should be supported by pleasant atmosphere, sound economic background and quality services for both the students and the employees.

We stand up for the original values, such as correctness and openness.

FIT maintained the outreach into many areas of IT fields.

How close do you think FIT is to this vision?
We have managed to pull through a difficult period caused by the pandemic and I don't think the faculty has managed to return to its earlier momentum and energy just yet. On top of that, we still don't know what is in store for us. If we manage to build relationships with students, innovate subjects, enhance our performance in science and research, and improve our contacts with the outside academic world, I think we will be on the right track. 20 years is an ideal time to recall the foundations of the faculty and to think about how we can further strengthen them in the future.

WE CHANGE

HISTORY

As time went by

14TH–18TH CENTURY
The compound serves as a monastery

1784–1964
The monastery was given to the army

1899
Czech Technical University (currently BUT) is established

1956
BUT is restored, a student interest group focused on cybernetics is established at the Faculty of Energy

1958
The term "information technology" appears for the first time

1959–1993
Faculty of Electrical Engineering

1960
Department of Automation and Measurement

1961
The first computer "LGP-30" is installed

1962
BUT has acquired the compound

1964
Department of Automatic Computers

1974–1985
ADT minicomputers

1976–1992
EC-line mainframes

1983
First terminal classroom

1985
Computer technology as a scientific field

1989
Department of Computers

1992
Internet connection available in Brno

1992
Department of Computer Science and Engineering

1993–2002
Faculty of Electrical Engineering and Computer Science

1993
Department of Computer Science and Engineering

1999
Rubber duck debugging

MID 1990s
Access to a central university computer

2002
FIT BUT

2002–2007
1st dean:
Tomáš Hruška

2004–2009
Construction and reconstruction of the FIT compound

2008–2016
2nd dean:
Jaroslav Zendulka

2009
Bitcoin

2011
Siri

2014
Connection to a supercomputer

2014
Research Centre of Information Technology

2016–2022 (2024)
3rd dean:
Pavel Zemčík

IF YOU WANT TO FOUND A FACULTY, YOU NEED A NOTEBOOK. PREFERABLY A LINED ONE

He has been coming to the building at Božetěchova since 1969. When Tomáš Hruška spent days and nights here working with a mainframe computer as a student at the Faculty of Electrical Engineering in the 1970s, it probably would not have occurred to him that he would one day be the first Dean of the Faculty of Information Technology to be established here. He still remembers founding of FIT as one of the most enjoyable periods of his long career.

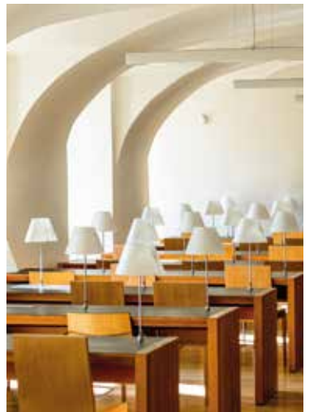
Tomáš Hruška / Dean of the Faculty of Information Technology in the years 2002–2007, Vice-Rector of BUT for Information Technology in the years 2018–2022

When and why did the original idea to found the faculty materialised?
The first impulse came back in 1991, but unfortunately an individual faculty wasn't established at that time. Our only achievement was that the Faculty of Electrical Engineering was renamed to the Faculty of Electrical Engineering and Computer Science, which was a good marketing move at the time. Information technology began to be used more and more frequently in the world, there was great interest in it and it was clear that it wouldn't remain just a theoretical science about computers and programs, but that this field has a great future. However, the Masaryk University beat us to it in 1994, so unfortunately, we didn't become the first faculty of informatics in the Czech Republic, but this only motivated us to devote rest of the decade to making preparations so that we could act when the right time came.

So when was the right moment?
It was a long-term effort. First, there was a need to have some qualified people who would be able to hold relevant positions in case the faculty would be established. We succeeded because we had managed to gain four professorships at the Department of Computer Science and Engineering in the 1990s; this department then laid down the foundations on which the faculty was established. The second part was getting outside support. In this regard, we were aided by the fact that two faculties separated from BUT, which were then involved in the foundation of the Tomáš Baťa University in Zlín, and so our university needed more students. At that situation, establishing a new faculty appeared to be a good solution of the issue at hand and, after many discussions and negotiations, it became a part of the university's long-term plan. We had a lot of work ahead of us preparing the documentation for the accreditation commission, which eventually approved the establishment of a faculty, and so a new Faculty of Information Technology was founded on 1 January 2002.

What was the biggest organisational challenge?
Nothing in particular. Apart from a complex administration, you also need people, money and spaces. As soon as we had this, everything went well. A couple of colleagues warned me about what can go wrong, but if you make enough preparations, there is nothing to worry about. For this, I recommend you get a notepad, a lined one if possible, or an Excel file in which you can write down everything you need. We knew in advance how many people we wanted in which department, how much money we needed to do that and where we could get it, as well as how many students we wanted and could actually have. Everything was prepared in a great detail. At that time, it was generally possible to make a lot of decisions quickly, and since it was a good time to found a new faculty both for us and for the entire BUT, it went relatively smoothly.

Did the separation damage relationship at BUT?
Not at all. I know that this isn't always the case, so I have to thank professor Vrba, the then Dean of the Faculty of Electrical Engineering and Computer Science, and others, such as the then Rector of BUT, Jan Vrbka. Contrary to what we could see at other universities, where faculties focusing on informatics also gradually began to form and become independent, there were no fights over students, property or name between faculties or individuals at BUT. In the beginning, we were given 120 students, all doctoral students from the Department of Computer Science and Engineering and premises at Božetěchova street. I think the separation benefited both faculties, i.e., both FIT and present-day FEEC, because they are still successfully developing on their own. Furthermore, our relations remain very good, this is evidenced, for example, by the ball, which we are still happy to organise together.



In the beginning, there were 120 students at FIT. Today it is over 2500.

The faculty is stable, has a beautiful compound and it is sought-after.

Did you start from scratch at Božetěchova?
Not in terms of reputation. The faculty was established from the Department of Computer Science and Engineering, which already had a good reputation. The situation concerning foreign relations was much worse as there weren't many foreign contacts there before 1989, and there were no people who would establish them. Fortunately, much has changed in this regard over the last 20 years.

You linked virtually your entire career with FIT. What kept you here?
I like the unique environment of FIT. But most of all, I would be very hard pressed to find such a good team elsewhere. A faculty isn't a corporation, it is mostly about long-term work with people. Therefore, it is necessary to find such colleagues who will do what they enjoy and, at the same time, contribute to the whole. At the very beginning of FIT, it was Zdena Rábová who deserves most of the credit for making it happen, she was the glue that bound the faculty together, and I'm glad that we are still able to maintain it this way. Especially when it comes to managerial positions you need people for whom the word "I" is way below "we" on the list of priorities. In my opinion, no successful IT expert can do without qualities such as humility and fairness.

When you look at the current state of the faculty, did the visions you had when founding it come true?
When I was handing the reigns over to the new Dean ten years after taking over the Department of Computer Science and Engineering, but I wasn't handing over a mere department but a financially strong and relatively reputable faculty located in a new campus, I had a feeling of a job well done. Many things have changed since then, even the field itself has changed completely. Today, FIT has much more students and employees and the manner of funding has changed entirely. The faculty switched to mass teaching and a department for grants (about which no one had any idea at the beginning) was created. Of course there is still much room for improvements. But the faculty is stable, has a beautiful compound and modern equipment and it is sought-after. If it also manages to maintain the human factor, then I believe we succeeded.

Declaration of the employees of the Department of Computer Science and Engineering of 21 September 2000

/ ABRIDGED

As members of the academic staff of the Department of Computer Science and Engineering, we have long-term responsibility for the development of this field of science. We believe that the current manner of cultivating this discipline doesn't correspond to its social impact and thus we propose the following change:

In terms of the development of information technology at the Brno University of Technology, we are convinced that the most advantageous and the only actually feasible option both for the Brno University of Technology and further teaching and cultivation of the field of information technology lies in the division of the Faculty of Electrical Engineering and Informatics into two faculties, namely the Faculty of Electrical Engineering and the Faculty of Information Technology.

Jaroslav Zendulka became the second Dean in the history of the faculty. He led FIT during his two terms of office in the period of 2008–2016. According to him, stabilisation was the greatest challenge the faculty had to face back then. *"I have taken over the faculty during a period of great growth. It grew fast in terms of the number of students, members of staff and premises. It was necessary to stabilise everything. And by stabilise, I don't mean to stop the growth, but it was necessary to stabilise the processes so they became routine, maintain the number of students and ensure sustainable financing,"* reminisces Jaroslav Zendulka.

During his next term of office, the faculty's compound gained a new building of the Research Centre of Information Technology, which currently houses the access point to the IT4Innovations supercomputer and a number of research laboratories, as well as the newly reconstructed premises of the "château". Another change occurred regarding the follow-up Master's studies, which were expanded by six new study branches.

Today, Jaroslav Zendulka is already retired, but he still watches the events at the faculty from afar. *"I think that the goals we set while we founded the faculty have been fulfilled. There is still some room for improvement around the faculty, but I would like for it to continue to do well,"* he says.

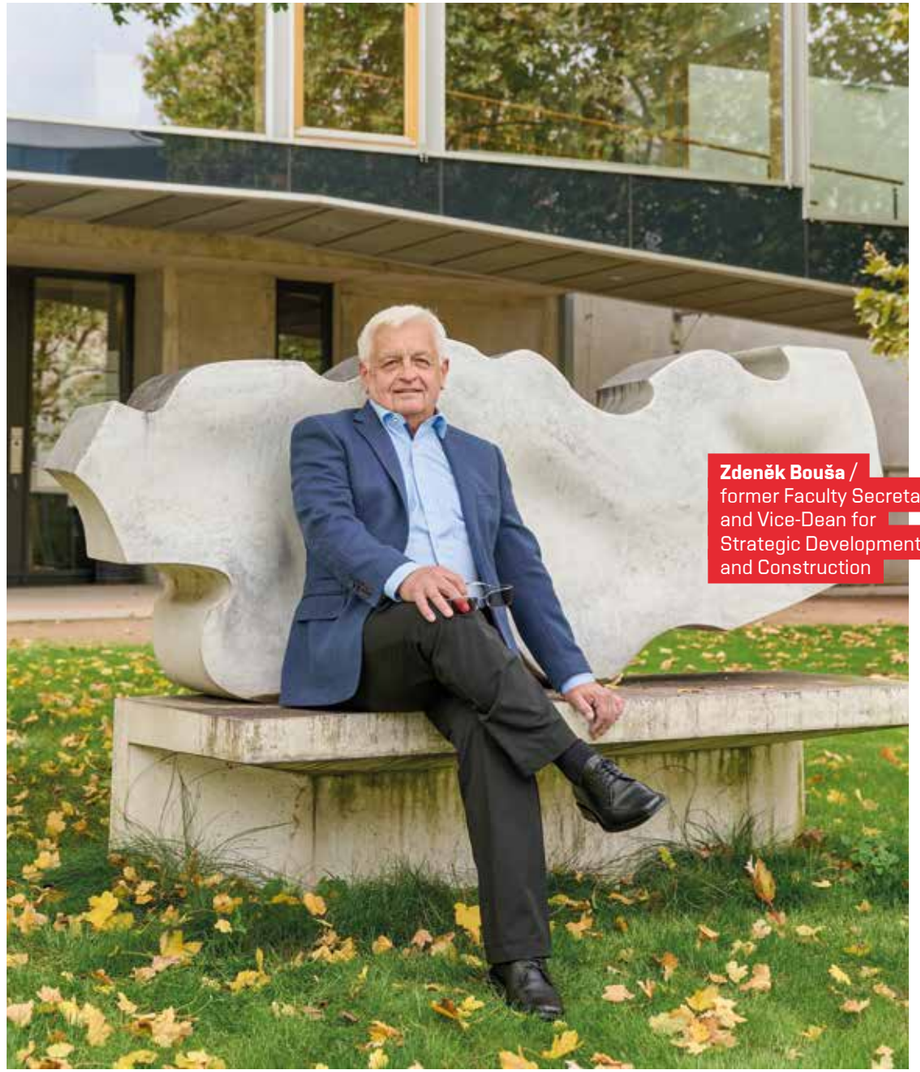
Jaroslav Zendulka / Second Dean of the Faculty of Information Technology in the years 2008–2016

KRÁLOVO POLE

WE CHANGE

MONASTERY, BREWERY AND A SUPERCOMPUTER. FIT MANAGED TO CONNECT THE UNCONNECTABLE

In 2002, when the Faculty of Information Technology was established, it was obvious that the future 2,500 students and their teachers would not fit inside the monastery. The Brno University of Technology had to decide whether to move the faculty to the new campus at pod Palackého vrchem or to stay in the monastery, undergo a demanding reconstruction of the heritage-protected building and try to acquire the former farmyard located on the other side of the street. ***"I think it was primarily the people from the faculty who have grown to love the monastery, who were most instrumental in the decision to stay at the cadet school. I believe they still don't regret their decision,"*** **says Zdeněk Bouša, former Faculty Secretary and Vice-Dean for Strategic Development and Construction.**



Zdeněk Bouša / former Faculty Secretary and Vice-Dean for Strategic Development and Construction

The Carthusian monastery can continue to serve the education.

According to him, the Faculty of Information Technology has one of the most beautiful compounds in Europe. Zdeněk Bouša walked the corridors of today's FIT as a student, Vice-Dean and a Secretary. He also remembers the times when the cadet school looked nothing like it does today and was literally about to be torn down, when the site of today's Pavilion L was a butcher's shop and when there was a coal boiler house on the site of today's lecture halls. When one entire wing of the former monastery was occupied by a mainframe computer and learning took place in the refectory and in the corridors.

When the idea to found a new faculty began to emerge, there was also the question: where to put it? It was clear from calculations and demographic curves that a space for **2,500 students** would need to be created. There were two options: the new faculty could stay at Božetěchova only if the land belonging to a former estate located on the opposite side of the road could be acquired from the city. Or, if new construction can be secured, it will move completely to the campus at pod Palackého vrchem. *"The idea of reconstruction and completion was eventually supported both by the mayor of Královo Pole and the Brno city hall. It is great that it worked out. I'm convinced that thanks to this decision, we have managed to save the cadet school for future generations,"* says Zdeněk Bouša.

The reconstruction and completion of the faculty campus was financially very demanding and cost almost CZK 800 million. The Ministry of Finance, but also the Ministry of Culture, the City of Brno and BUT itself contributed to the financing. The faculty has thus acquired a unique campus, which combines a sensitively reconstructed historical compound including a monastery, a château, and an old brewery with new modern buildings.

Architect Vladislav Vrána from ATELIER 2002 is the author of the design, as well as the first two stages of the completion and reconstruction. He invited the **architect Aleš Burian from the BURIAN-KŘIVINKA architectural office** to collaborate on the overall reconstruction and completion of the compound. *"Although we had been putting together plans for the redevelopment since the late 1990s, it wasn't until 2004 that the ground was first broken. In order not to stop teaching at the already existing FIT BUT, we had to build in two stages. First, a new building was built, into which the entire faculty moved for a time, and then the reconstruction of the former Carthusian monastery into a Baroque form continued,"* recalls Zdeněk Bouša.

There was so much groundwater in the historic cellars of the former estate that the first reports of their existence and what was under the surface had to be provided by divers. Today, the groundwater is being pumped out and used as utility water for flushing and watering. But the work started with the simplest part – demolition. *"Some parts were so devastated that they were collapsing on their own. The monastery brewery was in a better condition, although they say that if we gave it a shove using an excavator it would have collapsed too,"* recalls Zdeněk Bouša. However, it has been renovated for use as a catering and accommodation facility.

Many archaeological finds were made during the reconstruction. For example, a kiln was found, in which bricks for the construction of the Carthusian monastery were fired, or some bones. *"Fortunately, they were only horse bones,"* laughs Zdeněk Bouša. Every valuable find delayed the reconstruction. Most of the finds were made during the reconstruction of the monastery, where, in addition to finds from the periods of the Hussite wars or the Swedish siege, they also managed to save the torso of one of the oldest clockworks in Brno. Today, visitors can find it in the FIT Museum of computer technology.

"We decided at the beginning that the historic part will be used mainly for classrooms, lecture rooms and offices. We then needed to move the heavy computer equipment into the new building. There were those who said it was impossible, but not only was it possible, but it could even be done in a sensitive manner," says Zdeněk Bouša. The building of the Research Centre of Information Technology, which was built in 2014, was thus able to accommodate the technology of the computing cluster and data centre, which serve as the access point for the supercomputer located in Ostrava. At the time, it was one of the most powerful computers in the world. In practice, this meant a huge cooling capacity for a large server room; the excess waste heat is also used for heating at the compound.

"But some of the ideas didn't come to fruition. For example, we had to abandon plans for two floors of underground garages because of the groundwater. One floor had to suffice," says Zdeněk Bouša. On the other hand, he appreciates the fact that it was possible to bring all the utilities into one walk-through utility corridor under the faculty premises. In the event of a failure, this gives repairmen good access to all wires without having to dig them up. It is said that there used to be an underground passage to the Špilberk castle in place of the utility corridor, but who knows...

During his time at FIT, Zdeněk Bouša worked in three different offices and, like the other IT experts, he did not want to leave the historical premises 20 years ago. *"I like to walk around the cells or refectory of the former Carthusian monastery and soak up the historical atmosphere,"* he says. He adds that he is happy that a place was built which is used for teaching but is also open to the public.

"If it wasn't for BUT, I think the compound would continue to deteriorate. I'm glad that this architectural heritage has been preserved for future generations. We have revived this place and once again transformed it into a centre of Královo Pole and a centre of education. It's not only a faculty, but also a place where people can stroll through the gardens, sit at a café or even attend the Night of Churches. The Carthusian monastery can thus continue to serve the same purpose it did in the past, which is education," adds Zdeněk Bouša.

The campus is used for teaching but is also open to the public.

First Mass celebrated in a lecture hall at FIT

Although the monks have long since left the compound at Božetěchova, masses are **still celebrated in the adjacent Holy Trinity Church**. However, in 2005, the former monastery compound of the Faculty of Information Technology also took the opportunity to open its gates to the faithful. **Jan Zachoval**, a former colleague from the Faculty of Electrical Engineering and Computer Science, was ordained a priest in Královo Pole and the interest in his First Mass was so huge that all the participants could not fit inside the church. Therefore, about 150 people attended from the modern lecture hall, to which the entire Mass was broadcast thanks to the audiovisual facilities and technicians of FIT.

"What happened has exceeded all expectations. The lecture hall was filled to the last seat. Wheelchair users and mothers with strollers were at the front. To my amazement, the community behaved not as spectators but as living participants in the Mass. They stood up, knelt down, answered and their faces showed both interest and emotion," recalls **Jan Maxmilián Honzík**, former Dean of the Faculty of Electrical Engineering and Vice-Dean of FIT.

The priests from the church also learned about what was happening in the lecture hall and, at the end, they came to the lecture hall to give the sacrament of communion. *"Unbeknownst to us, this story made an indelible mark in the history of the faculty, for one, because it was unusual, and also because the famous monastery, which served its purpose for about four centuries and then was used by the army for another century before it fell into the hands of higher education institutions, briefly regained the purpose for which Karel IV's brother, Jan Jindřich, had it built,"* says another of the participants in the event, then Vice-Dean **Milan Češka**.

The first mass drew a lot of interest.

Jan Zachoval after ordaining.

The former monastery opened its gates to the faithful again.

The FIT compound – an object of cultural heritage that withstood wars and imperial decrees

Thanks to the varied past of the former monastery, FIT is the only faculty with a campus containing:

- relic chapel;
- preserved monastic cells;
- medieval latrine (in room No. A211),
- own château registered on the list of châteaux in the Czech Republic;
- student club located in a brewery fermentation room;
- two cloister gardens;
- refectory;
- gothic cellars

The only preserved unaltered charterhouse in the Czech Republic stands in Brno, at Božetěchova. For the last 20 years, it has housed FIT BUT, which may seem like a tiny fraction of its long history dating back to the 14th century, yet it seems as if the compound has been waiting for this period all along. Consider what it had to go through and what it had to endure just to become the backbone of technological progress:

Founding of the monastery
The Carthusian monastery was founded in 1375 by Margrave Jan Jindřich, who donated his private residence and land in Královo Pole to the monastery. To this day, it is still unknown why he did that. Did he want to do a good deed to ease his conscience before he died? Or did he want to be forever associated with an important monument? Either way, he stood at the beginning of the turbulent history of the monastery, as well as the entire Královo Pole.

The construction of the Holy Trinity Church began in 1375. The Carthusians also owned extensive properties in Královo Pole, a mill in Dornych, vineyards in Obřany and the villages of Střelice and Černovice. They also held a number of rights and privileges that allowed the monks to practice their ascetic way of life undisturbed, immersed in silence, work and prayer.

The indestructible charterhouse
The monastery was damaged, plundered or even burnt down many times during its existence. The Hussites, King Matthias Corvinus' troops, Protestant troops during the Bohemian Revolt and last but not least the Thirty Years' War all took their toll on it. During their campaigns, the Swedish troops destroyed most of Brno suburbs, but the charterhouse in Královo Pole miraculously survived. That is because the commanding general chose it as his headquarters during the siege of Brno.

At its peak in the second half of the 17th century, the monastery had a church, a chapter, two chapels, a priory and a sacristy, as well as a garden, ponds and a farmyard with stables, a brewery and a barrel-making workshop. The compound underwent two Baroque reconstructions.

The second, a late Baroque reconstruction, which begun in 1765, is followed by the current form of the monastery, given to it by FIT at the beginning of the millennium.

No women allowed
The Empress Maria Theresa herself came to visit the monastery. According to legend, the monks refused to let her in because she was a woman. They even reportedly blocked her way. The Empress eventually left, and the monks pulled all the stones touched by her feet from the pavement.

General Laudon and the Brno brewery
Who knows if the unsuccessful visit of the Empress played a role in this, but after 407 years of operation, the monastery shut down. In 1782, Emperor Joseph II had it closed and soldiers moved into the compound.

In the era that followed, even the artillery regiment of the legendary military commander General Laudon was stationed at the former monastery. Later, it was occupied by gamekeepers, a cadet school or, in 1920, by a telegraph battalion of the Czechoslovak army.

After the dissolution of the Carthusian Order, the fate of the former farmstead developed independently. The local château became the seat of the nobility and later belonged to the princely family of Schönburg-Hartenstein. The monastery brewery was turned into a malt house and leased to the Brno Moravia brewery. In 1945, the buildings became the property of the state and it was not until after the revolution in 1989 that they fell into the hands of the municipal district of Královo Pole. In the 1990s, they housed offices, workshops, warehouses and commercial premises.

The compound changes owners
In 1964, the Brno University of Technology acquired the former Carthusian monastery as a replacement for a church building on the Antonínská Street. But before the Department of Automatic Computers, the predecessor of today's FIT, could move in, it was more than necessary to perform a reconstruction. The capacity of the building was not sufficient for the people, let alone the large mainframe computers, and in some places the plaster was literally falling on people's heads. Gradually, new lecture hall complexes were built in the compound and finally, the decision was made to establish an independent Faculty of Information Technology. It meant a new life for the former Carthusian monastery, especially for the premises of the former farmyard.

WE CHANGE THE WAYS OF THINKING

WE ARE NOT JUST GIVING OUT TIPS AND TRICKS. WE WANT STUDENTS TO BE ABLE TO COME UP WITH THEM ON THEIR OWN

Richard Růžička /
Vice-Dean for Educational Activities in Master's Studies

Although IT is a dynamic field and new technologies are constantly appearing, the fundamentals of teaching remain the same. *"We aren't preparing graduates for their first job, but for a 40-year long career. The successes of our graduates can be easily seen. At FIT, we believe that the perspective that their academic education has given them plays a big role in this,"* says Richard Růžička, Vice-Dean for Educational Activities in Master's Studies.

How would you introduce studies at FIT to someone who does not know the faculty at all? What is actually taught there?
As the Faculty of Information Technology, we emphasize the technological and practical side of the matter rather than just the theory of informatics. What I see as a unique trait of FIT is that we try to constantly balance the academic and technological perspectives and create a balanced mix of the two for our students. Our graduates are not only able to work in the industry and develop new technologies, but also gain broad perspectives and theoretical background to fall back on.

This being said, IT is an extremely dynamic field that is constantly evolving. How do you deal with this in your teaching?
This is directly related to the balancing of theoretical and technological subjects that I was talking about, because the changes in the field are mostly related to the development of technology, whereas the theoretical framework remains relatively stable. For these reasons, we at FIT regularly innovate our study programmes, either en masse once every 5 to 10 years or in little details at least once a year. So IT wasn't the only thing that changed over the last 20 years, teaching at FIT did as well. But don't imagine that teaching is directly driven by technological changes. Such an approach wouldn't be effective in the long term. We try to build our study programmes so that what we teach here serves students throughout their entire careers.

So what do students gain from this?
I will start with what students think they will gain. When they come to us, they often want information, facts and tips and tricks on how to do various things. There is a persistent belief in society that you can tell an expert by how much he or she knows. But the university is not really just about getting as much information as possible. If that were the case, all you would have to do is read everything on Google. But this wouldn't improve you as a person, or the whole industry, in any way. In the same way, you will only employ tips and tricks on problems that are already well known, but our graduates will be faced with new problems and it will be up to them to find solutions. This is where getting higher education will help them. Our students will undergo systematic brain training and thus create certain mental structures in their heads, thanks to which they will then know how to approach problems, how to decompose them, where to draw from and so on. That isn't something you can just find on Google.

There is a popular belief that you do not need a university degree to be an "IT guy"...
I'm not really questioning it. But it's important to remember that IT is a very heterogeneous environment where different positions and different companies are represented. Unlike medicine or law, for example, it's difficult to tailor a study programme to a specific position, and it's true that it's possible to find a job without higher education. But it would be a shame to deprive yourself of the academic perspective that can help in the later stages of your career, when you need something to build on when technology changes again.

IT experts are in great demand and it seems that even if FIT were to take on twice the number of students, they would still all get jobs in the field.
Yes, there is a huge interest from the point of view of the society and employers, but studying is not industrial production. It cannot be expected that it will produce graduates with the specific parameters as demanded by the market. We work with people, not material, so it depends on who the students are, what their motivation is or how they approach their studies. They should also be treated accordingly, but unfortunately, due to the massification of the higher education, this isn't easy.

Is the current trend of mass higher education a problem?
This trend is not necessarily bad. The fact that more people are getting education is positive. But what we offer at FIT contradicts massification, because we have always wanted to be a top school, which will take fewer students, but the best ones, whom we can help to go as far as possible. We currently accept around 800 applicants for the first year of the Bachelor's degree, and not all of them are able to cope with our elite model of education. By "being able," we do not mean just the intellectual capacity; our study programmes are not that extreme.

However, the motivation of students, their expectations and ideas also play a crucial role. It's in this respect that it's very difficult to work with them in the current numbers. For example, in the United States or Western Europe, a similar problem has been solved by diversifying higher education institutions. I would consider this to be an appropriate solution even here. If this could be done, we could leave some of the students to other schools that would educate them adequately to who they are and what their ideas and needs are, then the social demand for mass education could be satisfied in a much better way.

How does the connection between studies at FIT and practice looks like?
Many of our students get in touch with practice by working while they study. However, they will not be required to complete an internship in a company as a mandatory part of their studies. Given the plethora of IT positions that exist and our inability to know what kind of environment will the graduates get into, we feel that an internship would be ineffective. We provide links to the real world practice through our lecturers and various guest lecturers, as well as through research projects or summer internships at our industrial partners. However, we are trying to make our students employable anywhere and to make them able to always keep up with technological developments. Therefore, I would like to recommend all students to let the theoretical-technological cocktail we are mixing for them have a proper effect on them. They will gain experience on how things work in a company very quickly even after their graduation, but they will probably not be able to catch up on the academic education they would have missed because of their internships. The successes of our graduates can be easily seen. At FIT, we believe that the perspective that their academic education has given them plays a big role in this.

At FIT we try to constantly balance the academic and technological perspectives.

Extracurricular activities for students

Student conferences, lectures by foremost experts and even a rock music festival. FIT is not just about lectures. Various events held throughout the whole year bring life to the Faculty of Information Technology.

EXCEL@FIT
Excel@FIT is an annual student conference on innovation, technology and research in IT. Students can use it to present their ideas, technical solutions and professional results in an unconventional way. Their work is judged by the professional and general public as well as corporate experts, making the conference a unique opportunity to get feedback from industry experts, share ideas and experiences, and meet interesting people.

STAR(T)UP@FIT
FIT has long supported entrepreneurial thinking among students, especially through the Star(t)up@FIT programme. It provides the chance to consult with experts from the entrepreneurial and professional IT fields as well as a series of seminars on business topics and discussion meetings with successful company founders. Students also have the opportunity to visit the faculty's creative open-space, which functions as a startup hub, work there on their projects and meet with like-minded people.

LIVING IT
Living IT is a conference presenting innovative technology for all students who enjoy IT. It is a meeting of experts from among FIT's industrial partners, who use the event as a platform to present their technology and skills, and students, who have the opportunity to learn about the latest technological trends and innovations, as well as to meet the people who help to create them.

ROCK@FIT
Rock@FIT is a traditional music festival held annually at the Faculty of Information Technology. It features student and staff bands, as well as professional bands. The programme also includes a Closed Door Day – a special event for students during which various competitions or excursions are held on campus.

STUDENT UNION
The Student's Union of the FIT BUT is a students' organisation at the Faculty of Information Technology. Its mission is to mediate and facilitate communication between the faculty and the students and organise extracurricular activities. It is based in its club called U Kachničky. The Union organises a number of student events there, such as board game, table football and pool tournaments, music evenings and LAN parties. The Student Union has also co-organised major events such as balls, introductory events for first-year students and the Rock@FIT festival.

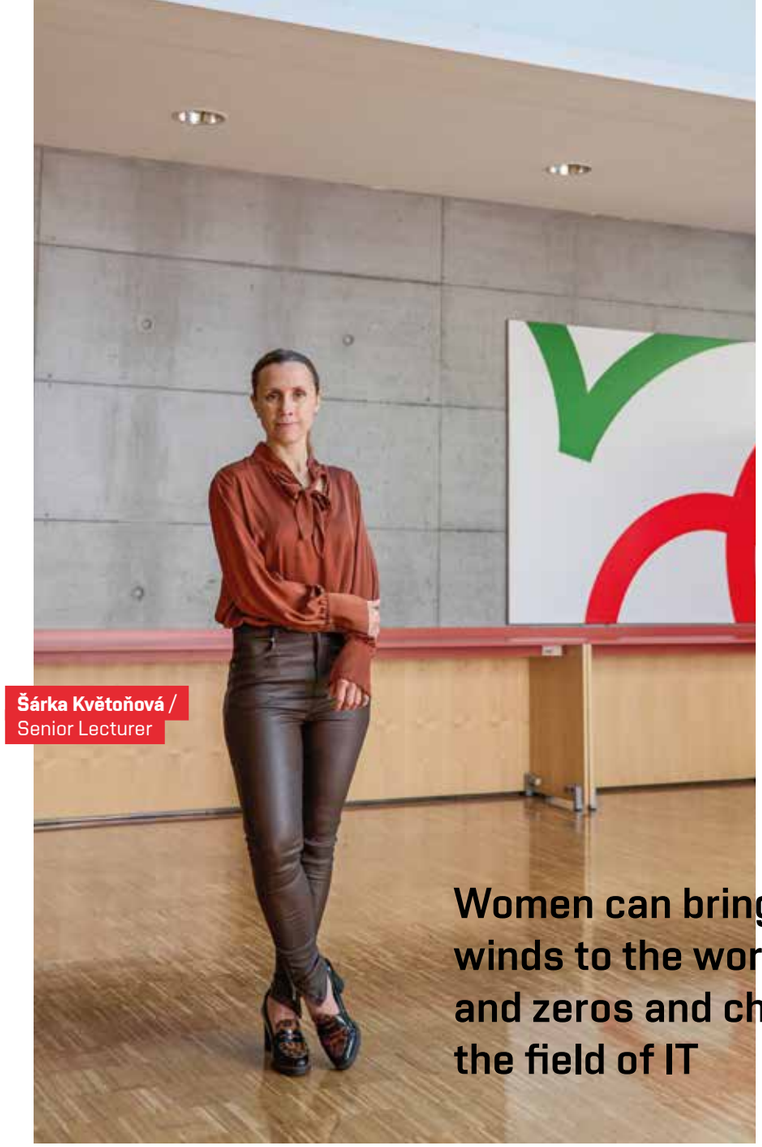
<F>IT SUMMER SCHOOL FOR GIRLS

Twenty years ago, there were only two girls among a hundred of IT students. Today, female students make up 11% of all students at the faculty. The fact that the field is becoming more and more attractive among female applicants is also due to the (F)IT Summer School for Girls, the oldest similar event in the Czech Republic, which was founded 15 years ago by Professor Jan Maxmilián Honzík. The management has been than handed over to Vice-Dean for External Relations Vítězslav Beran, however from the first days up to today the main organizer is Šárka Květoňová.

A week-long course for secondary school students, where the girls can learn the basics of programming, will be introduced to graphics and photography editing, as well as robots and chatbots, but will also visit IT companies where they can meet women professionals working in IT. *"It is important for young girls to see that information technologies are not just a domain of men and that this can be an interesting and creative occupation for the future,"* says Šárka Květoňová.

Even though IT fields are currently amongst those most sough-after, according to statistics, they also belong among fields with the least balanced ratio of the number of men and women employees. According to Šárka Květoňová, there are several causes. *"Girls are often discouraged by the people around them – parents and sometimes, sadly, even by teachers at schools – and they are told that IT is primarily a men's field. For girls who are not seriously interested in computers, this field of study is often hard to delineate, unspecific and rather distant. At the summer school, we try to bring them closer to it,"* she says.

As Šárka Květoňová adds, it is definitely not true that young girls "don't have the head for IT". *"Sometimes they just enjoy something else. Information technology is a broad field, and everyone can find their own niche in it, which is great. First, it is important to bear in mind that women form half of the population and this half is also using and will be using computers. To say the very least, it would be unwise for only men to be involved in the process of design, development and implementation of both technical or software components of IT. I believe that women can bring fresh winds into the "dry" world of ones and zeros and change the field of IT,"* says Šárka Květoňová.



Šárka Květoňová / Senior Lecturer

Women can bring fresh winds to the world of ones and zeros and change the field of IT

When knowledge is changing the world

Nearly nine thousand graduates have an academic title they earned from the Faculty of Information Technology written in front of or behind their name. More important than the degree, however, is the knowledge they have gained during their studies. They can apply the knowledge in many areas of life – whether in start-ups they establish after school, in development of applications or joining leading global corporations. In a survey conducted by the BUT, 87% of FIT graduates answered that they would not have the professional skills they have today if it were not for their studies at Brno University of Technology.

From a "garage" to the top

FIT graduate Jiří Tobola is the co-founder of Flowmon Networks, a developer of products for network infrastructure management and security. In its 14-year history, it has become one of the fastest-growing technology companies in the industry, with more than 1,000 customers in 45 countries.

Flowmon Networks started as a spin-off company of BUT, MUNI and CESNET, where Jiří Tobola worked as a researcher. *"Apart from the scholarship, which I gladly accepted, this also enabled me to work on my diploma theses which had a real-life impact and were not just an academic exercise,"* says Tobola. Our success is based on having a team of the right people for the job, motivation to make something great and strong technology.

The company recently completed its start-up journey, going from a spin-off and a "garage" stage to a double exit with the sale to Progress Software, an American publicly-traded company. *"The product itself has changed over time and will change further in the future, but if you have a great team, you can achieve quite unexpected success,"* adds Tobola.

Work leading to important discoveries

Jaroslav Kadlec, a BUT graduate, works as a software manager at Thermo Fisher Scientific, one of the largest manufacturers of electron microscopes in the world. He likes to surround himself with people he can learn from, and he also prefers job candidates who are interested and enthusiastic. *"It is often even more important to me than whether they can perfectly apply a skill they were developing for past many years. We are looking for people who enjoy learning and thinking. And there are many of those at FIT,"* he says.

Thanks to companies such as Thermo Fisher Scientific and Tescan, Brno is now the "capital city of electron microscopy", where 30% of the world's electron microscope production takes place.

"Our microscopes are used in the research of Zika and HIV viruses, they are enabling the development of new materials, as well as miniaturisation of mobile devices. We can see that our research changes the world and leads to important discoveries. That's a hugely powerful motivation," he adds.

The app that saves lives

In 2010, Zbyněk Poulíček was looking for a topic for his diploma thesis when he and his colleagues Boris Procházka and Petra Černá saw images of the Haiti earthquake on television. Pictures of people in the rubble with no one to help them gave them the idea for a new software application. Today, GINA (Geographical Information Assistant) saves lives in more than fifty countries around the world and has become part of integrated rescue systems and humanitarian interventions.

The software enables navigation in challenging terrain, team coordination and efficient exchange of geographical information via mobile devices. The app reduces travel times while protecting workers in areas hit by crises and humanitarian disasters.

The system has won a number of awards, including the national round of the Imagine Cup competition organised by Microsoft. *"Being mentioned by the BBC and getting an award from Bill Gates told us our strategy was sound. We've come to believe that we really can make a difference,"* says Poulíček. GINA's products have played a significant role in solving a number of humanitarian disasters over the ten years of the company's existence. Globally, GINA tablets handle up to 100 million calls per year, an average of one call every three seconds.

On the pulse of industry 4.0

During their Master's studies, Radek Štourač and Jan Štěpnička started their own business in software development for electronics manufacturers. *"That's the great thing about FIT – it brings together people who can complement each other professionally and career-wise,"* says Štourač, co-founder of Kinali.

Most of Kinali's employees come from FIT. *"We came to the conclusion that people from FIT are much better prepared for working with us than people from other faculties. During their studies, they encounter a lot more technologies that they can familiarise themselves with, and they are also given a lot more tasks to solve,"* says Štourač.

Kinali reinvests a tenth of its revenues into research and development and continues to co-operate with universities. *"This moves us forward in the business. This path is key for us – to keep pushing and innovating,"* adds Štourač, referring to Kinali's motto: *"Machines and robots for stereotypical hard work. Human potential can be used for more meaningful work."*

From university to a football pitch

Igor Potúček spent almost 20 years at Brno University of Technology. He now uses the things he learned, together with his colleague Stanislav Sumec, who is also successful graduate and researcher from FIT, mainly in the football business. The technology developed by their Panoris brand, which specialises in systems capable of automatically recording and analysing games, is now used by leading football teams to create better strategies and tactics.

"Many interesting companies and start-ups stem from the academic environment where you have the opportunity to meet interesting people and gain expert knowledge and experience," he says. The great thing about research, he believes, is that a person can invent new things, choose a topic that interests them and pursue it further. *"But as time went on, I wanted to move to things that would have a tangible impact. I wanted to put my knowledge into a product that would serve people,"* he adds.

In 2007, he founded Camvision, a company that initially focused on the use of computer vision and camera systems, for example in rail transport. Today, it records the most prestigious football matches under the Panoris brand.

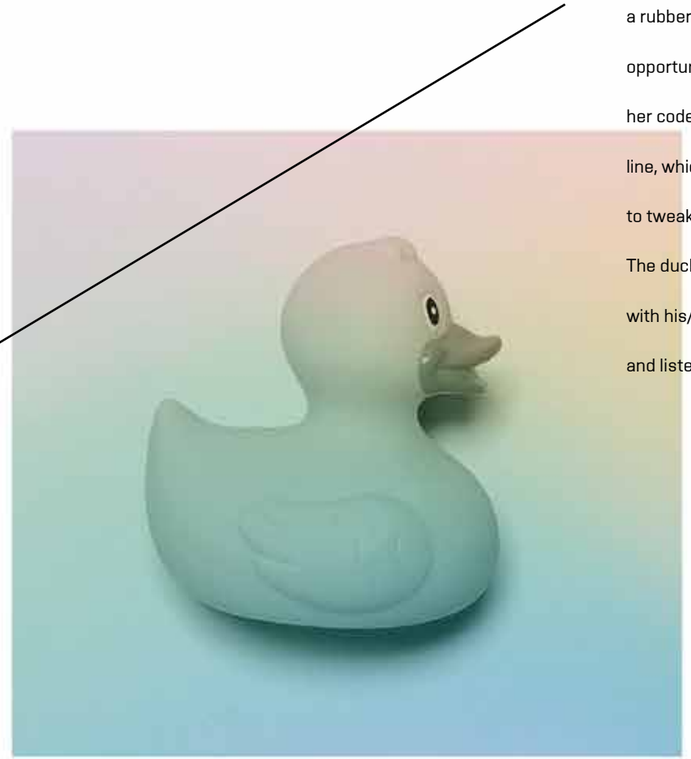
Sustainable growth for the world and the company

FIT graduate Roman Bohovic and environmentalist Jan Labohý founded World from Space, a company that analyses satellite data. *"When I was finishing my PhD, I found out that a revolution had taken place in space – a revolution in open data and artificial intelligence. And I wanted to take part in it,"* says Bohovic.

In 2018, World from Space was still mainly focused on processing urban vegetation data for the purposes of drought assessment and possible measures taken by city authorities. Nowadays, it helps increase agricultural production in countries such as Nigeria. Thanks to SMS messages, farmers know when to plant, when to irrigate and when to harvest. This increases household income by up to 200% and the money thus earned enable people to send their children to school.

"I would recommend that students look for meaning even in subjects and areas that they don't find so interesting at first. Because sometimes that meaning doesn't become apparent until later in life. That's how it was with me," Bohovic says.

Why is the symbol of FIT graduates a duck?



The programmer who owns a rubber duck has the opportunity to explain his/her code to the duck line by line, which will help him/her to tweak it to perfection. The duck never interferes with his/her explanations and listens patiently.

In the IT world, ducks refer to a method known as **rubber duck debugging**, which appeared in the book *The Pragmatic Programmer: From Journeyman to Master*. What is this about?

WE ARE CHANGING

SCIENCE

SCIENCE PUSHES US FURTHER. AND WE ARE PUSHING SCIENCE FORWARD

Tomáš Vojnar /
Vice Dean for Science and Research

Research is one of the pillars of the faculty, its staff and many students. At FIT, research is the responsibility of Tomáš Vojnar, Vice Dean for Science and Research. ***"Both basic and applied research is cutting edge at FIT and we can foster the transfer of ideas ranging from mathematics to applications developed with companies. That's what I find so great here,"*** **he says.**

IT is all around us, but not everyone considers information technology to be proper science. *"Science is all before you can place an advert for the product and find a company to make it for you. Just think of the times a couple of years ago when Google didn't exist. If you wanted to buy a search engine on the market, you just couldn't. No one has yet come up with its operating principles, implemented them and fine-tuned them. In short, the research has not yet been done,"* says Tomáš Vojnar about the importance of science in IT.

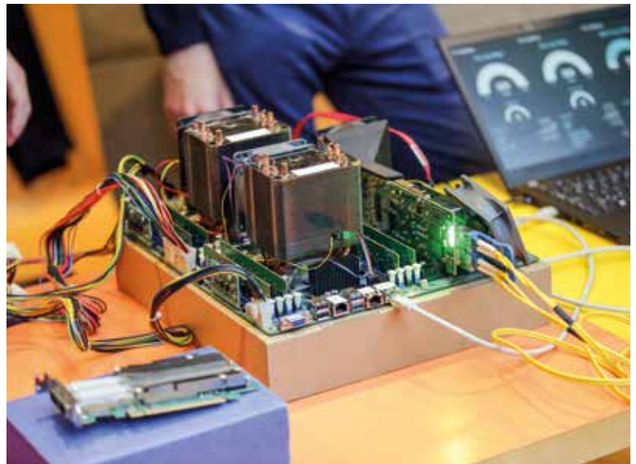
If he were to introduce science and research at FIT, he would start with a list and, as he says, just hope he doesn't forget to mention someone. He and his colleagues at FIT are involved in a wide range of IT disciplines in both basic and applied research, which is why they are able to respond well to global trends. *"Almost any time a new field emerges to the foreground, FIT has a stake in it. In recent years, machine learning has been an example of such an emerging field,"* says Vojnar.

In addition to artificial intelligence, researchers at FIT also deal with network security and other aspects of cybersecurity, automated analysis and verification, embedded computing and supercomputing technologies, evolutionary hardware, robotic and cyber-physical systems, the Internet of Things, and the theoretical foundations of computer science.

"We are pushing the boundaries of knowledge in many areas important to society. The results of this research then improve the quality of life for everyone – I am talking, for example, about security, smart cities, eGovernment, autonomous vehicles, smart agriculture and applications in medicine," says Tomáš Vojnar. He adds that it is also extremely important to be able to pass on state-of-the-art knowledge to students. *"Not only for the benefit of their careers but also for the development of the entire region. Only then we can build strong teams and companies that will attract other smart people,"* Vojnar says. That is why FIT tries to get its students involved in research as early as possible – already during the summer following their first year of study. Thanks to what is known as the project course, they can substitute part of the traditional learning for work on research projects. *"If they make it all the way to writing their diploma thesis, they have already spent four years in a specific research area, which is nothing to scoff at for a student. Maybe they'll just use the experience and go work in the industry. But there is always the possibility that one day they will lead a whole research team and push the possibilities of IT a little further still,"* says Tomáš Vojnar.

The faculty co-operates on research with a number of academic and industrial institutions in the Czech Republic and abroad. FIT works with them on national and international projects – both in grant-funded research, which clearly dominates, but also in contractual research projects. *"Both basic and applied research is cutting edge at FIT and we can foster the transfer of ideas ranging from mathematics to applications developed with companies. That's what I find so great here,"* concludes Tomáš Vojnar.

We are pushing the boundaries of knowledge in many important areas.



Both basic and applied research is cutting edge at FIT.

Research groups

Department of Information Systems
- Networks and Distributed Systems Research Group **(NES@FIT)**
- Hardware-Software Codesign Research Group **(Lissom@FIT)**
- Formal Model Research Group **(FM@FIT)**
- Information and Database Systems Research Group **(IS@FIT)**
- Management of Software Engineering Research Group **(MSWI@FIT)**

Department of Intelligent Systems
- Brno University Security Laboratory **(BUSLAB@FIT)**
- Security Technology Research and Development **(STRaDe@FIT)**
- Automated Analysis and Verification Research Group **(VeriFIT@FIT)**
- Intelligent Systems Research Group **(INTSYS@FIT)**
- High Performance Computing Research Group **(HPC@FIT)**
- Interdepartmental Robotic Research Group **(Robo@FIT)**

Department of Computer Graphics and Multimedia
- Speech Data Mining Research Group **(BUT Speech@FIT)**
- Computer Graphics Research Group **(GRAPH@FIT)**
- Knowledge Technology Research Group **(KNOT@FIT)**
- Computational Photography Group **(CPhoto@FIT)**
- Interdepartmental Robotic Research Group **(Robo@FIT)**

Department of Computer Systems
- Evolvable Hardware Research Group **(EHW@FIT)**
- Unconventional Digital Circuits Research Group **(POLY@FIT)**
- Supercomputing Technologies Research Group **(SC@FIT)**
- Accelerated Network Technologies Research Group **(ANT@FIT)**
- Dependable Systems Research Group **(DIAG@FIT)**

Made in FIT

A number of start-ups and spin-offs have been founded at the Faculty of Information Technology. Many of them are world leaders in their field today:

Phonexia. A start-up founded by six academics has grown into a globally recognised player in the speech technology market.

Codasip. A start-up company originally founded at FIT that is now a major global player in RISC-V-based processor technologies.

Camea. The company founded by university employees is one of the most important Czech businesses in the field of signal processing.

Tescan 3DIM. A FIT idea, now a division of the TESCAN group, developing 3D data visualisation software for use in medicine and electron microscopy.

ReplayWell. A start-up founded by FIT researchers dealing with the design and development of web and cloud services for audiovisual content processing.

NetX Networks. Originally a group that developed a platform for BUT, which today offers interesting solutions for high-speed networks to Internet service providers and data centres.

InveaTech / Flowmon Networks / Netcope Technologies. Invea-Tech was founded in 2007 as a technology start-up collaboration of Masaryk University and BUT. In 2015, it split into Flowmon Networks, a company that has become one of the world leaders in network traffic monitoring and analysis, and Netcope Technologies. BUT still has an ownership stake in the latter company, which has been successful in smart network card development, hardware acceleration and low-latency stock trading.

Netsearch. A group of FIT researchers developing solutions for cybersecurity and privacy on the Internet.

BrnoLogic. A company with BUT ownership interest which is based at FIT and is backed by researchers from the Accelerated Network Technologies Research Group in the development of FPGA and ASIC chips.

Cognitechna. A start-up, which together with many experts in the field of computer vision, artificial intelligence, signal processing and hardware design push the boundaries of the intelligent, state of the art solutions for camera and sensor data processing.

Our milestones in research

Firmly on the world map of research
Today, its speech recognition technology puts BUT among the five most important institutions, alongside Google, Facebook and IBM. It earned its firm place on the world research map in 2006. This was when the newly formed Speech@FIT group won a competitive evaluation organised by the US National Institute of Standards and Technology (NIST) in speaker recognition. Since then, the group has had countless successes at world competitions and a number of successful projects.

Surgery without a scalpel
The Supercomputing Technologies SC@FIT group has been working for several years on an international project aimed at simulating ultrasound propagation in living tissues and planning non-invasive ultrasound surgery. Using these simulations, doctors could, for example, remove a tumour from the patient's body without a single incision. Today, the project has almost 20 thousand registered users.

New patented method for augmented reality
The Computational Photography research group from FIT BUT in collaboration with Adobe Research has introduced a new method for augmented reality. The new tool, which was subsequently patented in the United States, was presented at the prestigious ECCV conference. The software can refine the position and orientation of the camera, and then offer various information about the surroundings via augmented reality in a mobile app.

Fighting cybercrime
The NES@FIT group has completed a ground-breaking project to research and develop next-generation tools to fight cybercrime on the Internet. It focused mainly on network traffic monitoring, analysis of network traffic logs and methods of local network security.

From academic research through a spin-off company to becoming a global leader
Founded in 2007 as a university spin-off, it is now one of the fastest-growing technology companies in its field. The founders of the company, originally called INVEA-TECH and born out of academic research, were FIT employees. The company was later split into two companies – Flowmon Networks, which was recently acquired by the US-based company Kemp Technologies, and Netcope Technologies, in which BUT still has an ownership interest. This feedback from the market then brought a number of other successes to the faculty – from the development of one of the first 100Gb cards to the successful commercialisation of P4 and receiving the Ministry of the Interior Security Research Award.

3D technology for breast cancer diagnosis
Collaboration between FIT researchers and several European institutions has led to the development of a new breast cancer diagnostic device. This 3D technology could replace conventional ultrasound and X-ray mammography in the future as it is more accurate and presents no radiation hazards.

Books from prestigious international publishers
In addition to many articles in peer--reviewed journals, the Formal Model research group headed by Professor Alexander Meduna has published ten books with leading international publishers such as Taylor & Francis, WIT Press, Springer and Wiley.

WE WANT TO CLOSE THE GAP BETWEEN SCIENCE AND INDUSTRIAL APPLICATIONS

The private sector and academic research are not two hermetically separated areas of life. They need each other. The Faculty of Information Technology is a place where they can meet. This is what Vítězslav Beran, Vice-Dean for External Relations, who is in charge of FIT's co-operation with companies, wants to encourage. Companies co-operate with the faculty, for example, in teaching and research.

Vítězslav Beran / Vice-Dean for External Relations

The partners may co-operate with us in classrooms.

So what does the co-operation with industrial companies look like at FIT?
We collaborate with companies by means of contractual research and also via our partnership programme, and these areas often cross over. In research, we help companies solve technological or software problems which require expertise or equipment they lack, or we work with them to develop a product directly. If we find mutually beneficial expertise overlap with the company, the company becomes our partner and can offer jobs to our Master's studies graduates, propose topics for Bachelor's and Master's theses, offer summer internships, and can participate in events for partners, such as the We Live IT conference or the Excel@FIT student conference.

There is a great deal of interest in working with FIT today. Which companies can become partners of the faculty?
We choose partners who are involved in more advanced technologies and who need at least Master's degree graduates to work with them. A company that "makes do" with a first-year student is not interesting to us because it will not help us motivate and push students forward. We also look at the company's added value in the field of science and research and its objects of business. Of course, there are also companies that we approach ourselves because we see the potential benefits for students and academics. We currently have around 40 partner companies.

What does the partnership bring to a company? And what does it bring to the faculty?
In this way, companies will become visible as potential employers of our students and will get invited to our events for experts and professionals. If they work with us on contractual research, then they also get new improvements or products, of course. Co-operation with industry helps us and our students to stay in touch with industrial practice, which is changing rapidly in IT. We allow our long-term partners to establish laboratories or other facilities within the faculty's premises so as to enable the companies to be in direct contact with the researchers, as well as students who may work in such establishments as a part of their studies. The partners may also co-operate with us in classrooms, where they can present our joint research activities through hosting lectures and professional seminars.

Co-operation with industry helps us to stay in touch with industrial practice.

Do you also choose companies for contractual research?
Yes. We believe it is crucial for the scientific co-operation between our researchers and the industrial partners to be mutually beneficial in the long term. It does not make sense for us to co-operate with companies that operate in different fields than those in which our own experts are involved. Moreover, if we want to stay on the cutting edge, we need to address innovative problems, not develop one mobile app after another. Our science must advance the possibilities of applications in the industrial sphere to help our partners be globally competitive. Likewise, real problems, data and practical experience must help us stay on top of world research.

FIT BUT IN MEDIA

"FIT-developed system for answering human questions succeeded in a trivia quiz: it competed against both machines and humans."

"FIT computer science program **sculpts implants** for head injury patients."

"Brno team investigates mysterious voices, works for the US military and Facebook."

"FIT research brings new effective tools to **IoT security.**"

"FIT researchers working on a new platform to help analyse space data."

"Who is the leader in AI development? Czechia!"

"The gold medal at the International Engineering Fair won by a **BUT robot**: It can find a person under rubble or in an avalanche."

"Brno scientists teach computers to put licence plates in focus, read blurry old books and recognise faces in crowds."

"Scientists in Brno have created a realistic model of the lungs for use in drug testing."

"A **robotic workplace of the future** is being built in Brno: even a layman can run it."

"Czech idea will help fight counterfeit paintings."

"A Czech student in the US helped to expose the weaknesses of **virtual reality.**"

"**Precision without radiation**: researchers at FIT are developing a device that could revolutionise mammography."

"New laser backpack creates state-of-the-art maps."

"FIT researchers used artificial intelligence to save energy in computers."

"Researchers from FIT BUT are working to effectively **connect data from smart cars and buildings.**"

"Czech algorithms from FIT aid digitalisation of Finnish timber industry."

"FIT scientists working on development of an app aiming to make psychological care more effective."

"Overloaded emergency lines? **AI will help.**"

"**New technology from FIT** to help with pilot training."

"Google, Facebook, IBM and Brno – BUT ranks among the world's top five institutions in speech recognition."

"European project involving FIT will provide smart content to help content creators and game developers."

"FIT researchers developed a new method for **augmented reality.**"

"Virtual reality as a form of psychotherapy: a special program under development at FIT."

WE ARE CHANGING

THE BOUNDARIES

PEOPLE ARE THE GREATEST WEALTH.

INTERNATIONALISATION IS OUR OPPORTUNITY

Jan Černocký /
Head of the Department of Computer Graphics and Multimedia

A team of researchers around Jan Černocký is one of the world leaders in the field of speech analysis, language and speaker recognition. Thanks to this, researchers from all over the world are interested in working in his "speech group". There are currently people from 10 different countries on his team. *"If you want to be at the top, internationalisation is your only chance,"* he says. But it's also hard work, he adds.

"Brno" is a known phenomenon in the international speech processing and natural language research community. *"A lot of researchers have been here. At the same time, it is known that there are skilled people from here who work abroad on internships, in large companies and research institutes,"* says Jan Černocký. Technology companies have grown up around the skilled people involved in this research, so it is no wonder that Brno is sometimes called the "Speech Valley" and people who want to work or study in the field head there.

But the journey to reach such world-renown was neither short nor easy. Twenty-one years ago, even Jan Černocký had no idea that it would lead through Brno. "I was on a study stay in the United States at the time and I was thinking about what to do next because I didn't really want to return to Brno to my former workplace. Then I got a call from Pavel Zemčík, the current dean, whom I didn't know that well at the time, that a new faculty was being established and he offered me a job there," he recalls. It took him a day to mull it over.

"It just went beautifully. We started in a small group, but we found a good environment here, which is important to get new things going," he says. However, they started from almost scratch with regard to internationalisation. *"The most important thing is to try it out for yourself, so we've been all over the world. Then it's important that people out there know you're good. This started to happen around 2005 when the first successes in international evaluations came and we started to make important connections. Moreover, being open and having institutional support is key. That's what we try to do as much as possible,"* says Jan Černocký.

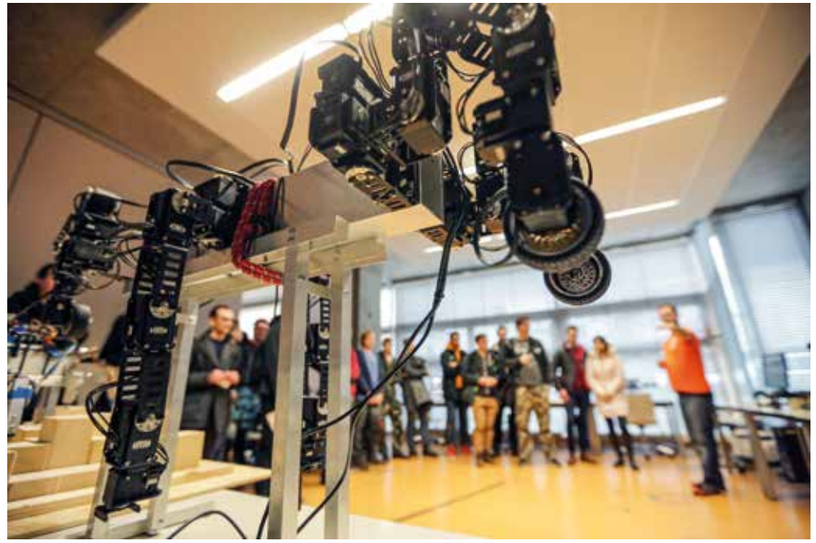
People are the greatest wealth, he adds. *"We have good universities here, but also fierce competition and very little mobility. Internationalisation is our chance to stay on top,"* he says, adding that it costs a lot of work and money, but it is worth it. And that goes both ways.

"I encourage my colleagues to go out, even at the cost of having to divide their work among others or doing it myself. Indeed, most of them have spent months or years abroad. If they come back, I'm thrilled to have people with that kind of experience in my lab, but should they choose to stay abroad, I'm glad to have my people in important places. It's a win-win situation," says Jan Černocký.

Maximum openness is the key, he believes. *"Our group publishes its work, of course, but we also make our results, data and models available to the community and organise conferences and events. In the long run, this will certainly pay off more than concealment and obfuscation,"* he concludes.

Brno is a phenomenon in the international scientific and innovative community.

Internationalisation is our chance to stay at the top.



Maximum openness is the key in science.

The two universities established collaboration.

Summer school at FIT for students from Kenya.

The experience of a lifetime? An internship in Africa

Experience from abroad does not necessarily only bring new expertise. Jan Pečiva had a completely different experience. When he finished his PhD at FIT in 2008, he was looking for what to do next in his life. *"I could have gone to foreign universities or taken up job offers in the industry. But I wanted more,"* he recalls.

He learnt about the University of Nairobi, the capital of Kenya, on the Internet through Opus Dei. As he says himself, a year of living in Africa changed him. *"Teaching there is really not just about imparting information and skills. Students perceive what you do and how. Whether you are selfish and sometimes breach your principles to solve a problem, or you are responsible and stick to your principles even if it is to your disadvantage at the moment,"* says Jan Pečiva.

His eyes were opened by the differences he saw between the rich and the poor there. *"Only the rich can afford to study at a university there. It is not so evident here, but I have become aware of the moral responsibility that universities have – to educate an intellectual elite that will wisely lead society, help manage the environment well and unlock the great potential hidden in human beings,"* he says.

As he says, after a year he came back a different man. *"What I experienced and saw changed my life for good. People in Africa live their lives and know how to be happy. I wouldn't be so sure that people in Europe can do the same. Maybe Africa is a challenge for us to discover something that our society has lost,"* says Jan Pečiva. Upon his return to FIT, he helped the two universities to establish collaboration as part of which the faculty teaches online courses in IT security and has invited 22 students over from Kenya to attend two summer schools in Brno.

400+

FOREIGN PERSONALITIES FROM IT FIELD HAD THEIR KEYNOTE AT FIT

89

PARTNER UNIVERSITIES

1 073

DEPARTURES OF FIT STUDENTS WITHIN MOBILITY PROGRAMMES

500+

OF FOREIGN TRIPS OF ACADEMICS WITHIN MOBILITY PROGRAMMES

965

ARRIVALS OF FOREIGN STUDENTS WITHIN MOBILITY PROGRAMMES

31

STUDENTS FROM 31 COUNTRIES

Tradition in organizing international summer schools

BISSIT 2019

The faculty has been organizing international summer school BISSIT (Brno International Summer School in Information Technology) since 2019. It offers courses in cyber security, machine learning and interactive applications to people from around the world. During two weeks participants receive theoretical and practical seminars, as well as visits to technology companies or informal trips to interesting places.

Since 2004 FIT has been actively involved in organizing thematic summer schools within SOCRATES/ERASMUS IP.

The partners of project have rotated in organizing; FIT took care of organization in years:

2004 → **Socrates Intensive Programme,** topic: **Applied Informatics and Multimedia**

2009 → **Socrates Intensive Programme,** topic: **Computing Aspects of Computer Games Development**

2013 → **ERASMUS Intensive Programme,** topic: **Computer Vision and Computer Systems**

In **2016** and **2017** FIT organized a summer school for students of **University Strathmore in Nairobi, Kenya**.

Mireia Diez Sánchez /
Researcher

From the Basque Country to Brno.

Mireia Diez Sánchez came to FIT to teach computers to understand human speech

Mireia Diez Sánchez has been working as a researcher at the Faculty of Information Technology for over five years. During her doctoral studies, she came to Brno for an internship, which she liked so much that she returned here for postgraduate research, for which she received the prestigious Marie-Curie grant. She ended up staying in the BUT Speech@FIT research group, where she works on speech diarisation.

The original plan to stay in Brno "just for a couple of years" changed a bit. *"In Spain we have a saying: 'Life happens just when you are starting to plan it.' And I guess that's true,"* she says with a smile. She recently started a family in Brno with her husband – a colleague from her research group. And after a short break, she is returning to her research.

She works on speaker diarisation, where the task is to identify who is speaking in a recording, recognise their voices, and break up the conversation at points where the speakers change. *"This is seemingly a very easy task for a human, but it is a very challenging problem for a computer in automated processing. Automatic diarisation systems then find many practical applications, for example in multimedia indexing,"* she explains. To solve similar tasks, she uses advanced statistical methods and deep neural networks.

Mireia started working with speech-related technology during her university studies in the Basque Country. Over the last couple of years, she added Czech to her language repertoire that already includes Basque, Spanish and English. *"It is said that learning a fourth language is easy. I guess that's true when it's not Czech that you're learning. But I can already read written text, understand what the others are saying and not get tired when I spend the whole day among Czechs,"* she laughs. She admits she is not fond of the long Czech winter nor the fact that she is so far away from her family and friends in Spain. *"But I've got used to Brno already. It is a beautiful and friendly city with a pleasant atmosphere. There's good public transport, great food and plenty of opportunities to travel,"* she says.

WE ARE CHANGING

THE FUTURE

What will our industry look like in 10 years and what will we be researching?

What does the future hold for the faculty and the entire field of IT? What will we research at FIT and what will the faculty look like? We are already charting our path for the next 10 years, but nothing is ever certain in a dynamic industry like IT. As our motto is "Times change – also thanks to FIT", let us conclude by letting our imagination run wild about what might change over the next 10 years. At the 30th anniversary of the faculty, we could look back and see to what extent our ideas and expectations were fulfilled.

Targeted treatment options will improve
Jiří Jaroš
< Supercomputing Technologies Research Group – SC@FIT >
I'm a bit of a sceptic, so I think there will still be a greater demand for computing power than we can meet. Anyway, there will be a gradual transfer of computationally intensive applications to supercomputers and the cloud, and people will use simpler and simpler terminals as their personal devices. Great advances will be made in medicine, particularly in the field of automated screening and diagnosis of various diseases, as well as the possibilities of precisely targeted treatment, which will be increasingly supported by software simulations and artificial intelligence.

Algorithms will better understand people
Jan Černocký
< Speech Data Mining Research Group – SPEECH@FIT >
"Easy" tasks, such as operating voice assistants in quiet conditions and with a restricted vocabulary in one language, or speaker recognition from long clean recordings, have already been solved, algorithms are commonly marketed and achieve "super-human" results. But in difficult conditions – noise, new languages, new domains or even dialects – humans still greatly outperform machines. In our field, we work hard to match human performance even under these difficult conditions. Much of this is aided by the "convergence" of machine learning – whereas a decade ago, speech research, computational linguistics or computer vision were separate fields, artificial neural networks have brought these fields together and developments in all areas have accelerated. In the future, we will definitely see more teacher-less training, automatic data crawling, multimodal approaches, and human user-centred development.

Crime will move even further into cyberspace
Jan Kořenek
< Accelerated Network Technologies Research Group – ANT@FIT >
In 10 years, programmable networks will be a commonplace commodity. P4 programmability will become a common feature of switches and network cards. Network deployment at 1 Tb/s will be the order of the day. FPGA technology will make its way into processors as a means of accelerating applications similar to GPUs. Crime will move even further into cyberspace. Network security as well as network attacks will actively use machine learning and artificial intelligence. Based on specific cases of data misuse, people will be shocked at what can be learned and exploited from the available digital traces and social media accounts. There will be an increased push for privacy protection.

Mathematics must remain the fundamental lingua franca of science
Alexander Meduna
< Formal Model Research Group – FM@FIT >
We strongly believe that mathematics must remain the basic "lingua franca" of science, including computer science if it is to face the crisis of European science, which Edmund Husserl, a native of Prostějov and founder of phenomenology, warned about. The language of mathematics will remain the language common to all of science. Therefore, we plan to continue to present our ideas in a strictly mathematical way; however, our focus will become more application-oriented. The main topic will be the computer processing of language, especially its analysis and translation. However, this orientation will no longer focus only on artificially created languages, such as programming languages, as has been the case so far. It will also focus on natural language translation, including the creation of a high-quality Japanese-Czech machine translator.

Supercomputer operations
Václav Šátek
< High Performance Computing Research Group – HPC@FIT >
The Navier-Stokes equations are still among the seven unsolved problems of the millennium. Moreover, we deal with extending this problem to include more complex boundary conditions, which introduce considerable nonlinearity into the problems – making them even more difficult to solve numerically. Practically speaking, we would like to focus mainly on modelling the blood circulation in the human body. The idea is that, for example, a doctor would mark the blood vessel he wants to sever on a tablet during surgery, and a supercomputer would calculate the pressure distribution and flow after the procedure.

Autonomous vehicle navigation, augmented reality and computational photography
Martin Čadík
< Computational Photography Research Group – CPHOTO@FIT >
Our methods will assist in the navigation of autonomous vehicles and drones. One of our applications – augmented reality projected directly onto the retina of the eye – will enable better orientation and understanding of nature for all age groups, including people with various disabilities. The photographic devices we have helped develop will capture a faithful "impression" of reality, which can also be freely altered without compromising credibility.

Network security based on the use of autonomous agents powered by artificial intelligence
Ondřej Ryšavý
< Networks and Distributed Systems Research Group – NES@FIT >
In the area of networking, virtualisation will be a major focus of attention, and the concept of programmable network devices will once again come to the fore. Here, we'd like to ride the wave of P4, which is a technology that big and important companies are pursuing. Another interesting topic is autonomous network security based on the use of autonomous agents powered by artificial intelligence.

Robots will collaborate with humans
Vítězslav Beran
< ROBO@FIT Research Group >
In the area of human-machine/robot communication and collaboration, it will be normal that robots will understand the production processes, equipment and objects in their environment, as well as the actions required of them. I do not see the future in complete autonomy of production robots, vehicles, drones, etc., but in the co-operation of these machines with humans, where both robot and human will do what each of them can do better and with less effort: the robot can perform repetitive actions, search for information and evaluate the situation, while the human can then define goals, possible solutions and make decisions. To do this, however, we need to find ways of effective communication between humans and machines. Even an inexperienced programmer can handle instructing a group of robotic manipulators and mobile robots in a natural way. Today we are trying to move towards this goal using, for example, augmented reality and automated situational awareness. We will see what possibilities will be brought about by technologies such as knowledge retrieval from the Internet, machine learning or reading brain activity.

Campus in 2032

The Faculty of Information Technology has not been afraid of daring architectural feats and bold plans since its inception. It continues to dream big. The visions are only on the drawing board for now, but that's where all the big ideas come from.

Cloister area construction
(by Štěpán Vrána – student work)
The study of information technology is increasingly in demand, but the FIT buildings' capacity has been nearly full since its establishment. Part of the classes must therefore take place outside the faculty. In order to concentrate all learning on the FIT campus, the faculty intends to construct new buildings. They could be situated between the north and south cloisters, on the site of two monks' houses previously existing on the site and now buried, and would contain rooms to teach mathematics and physics classes.

Experimental application laboratories for drone research
(by Atelier 2002)
In the field of information technology, new topics and subjects to be taught and researched at the faculty are constantly emerging. Artificial intelligence, cyber-physical systems and autonomous unmanned technologies are becoming the key areas. However, the development and research of drone technology require facilities for practical tests of their flight and navigation capabilities, and for simulating various tasks. The faculty would therefore like to build a test hall in the future, which should also include a water tank for underwater drone tests, as well as other specialised laboratories.

20 years of FIT BUT

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