

# The reliability engineer

From gear wheel edges to coil insulation: engineer **Dr. Zeljana Beslic** researches damage to develop more sustainable products.







**A single dent on the edge of one tooth; one flaw in the coil of an electrical motor //** Although barely visible to the naked eye, these kinds of defects could cause a vehicle to break down – rendering it completely out of action. To prevent this situation, engineers investigate problems, study damage mechanisms, perform complex calculations and measurement series over long time periods, and develop ways to solve the issues. This work is Zeljana Beslic's world. When the 33-year-old mechanical engineer talks about her job, she does so with a smile: »Me, a reliability engineer ...«

Beslic has proven herself reliable throughout her school and employment history. Her childhood curiosity about what a gear lever in a car

does and how the vehicle moves was encouraged by her father, a mechanic who took Beslic – an only child – along with him to his garage. Beslic followed the path of many an engineer before her, enjoying maths, physics and chemistry in school. Before taking her final leaving exams, she knew she wanted to study mechanical engineering. Art was another passion, but was destined to remain a hobby.

Even though Beslic grew up in the automotive metropolis of Stuttgart, she kept her options open when choosing the direction of her studies. Because she had a strong interest in power-trains, she attended Professor Michael Bargende's lectures on combustion engines. However, machine elements were what really captured her imagination, and she thus decided to focus on design engineering. After completing her preliminary diploma, Beslic started an internship with Bosch to gain practical experience of machine elements in an industrial setting. It



was here that she wrote her degree dissertation, in which she conducted an experimental investigation into a planetary gear train for an exhaust gas recovery system. Back then, in 2013, Beslic shared the view held by many other engineers with significantly more experience – she believed that alternative powertrains would become important at some point in the future, but the priority now was to engineer combustion engines for greater efficiency.

Once she had completed her studies, Beslic was looking to get stuck into her next scientific challenge. She remained at the Institute of Machine Components (IMA), taught younger students, managed the CAD lab and kept her eyes peeled for a topic for her doctorate. »Initially I spent a lot of

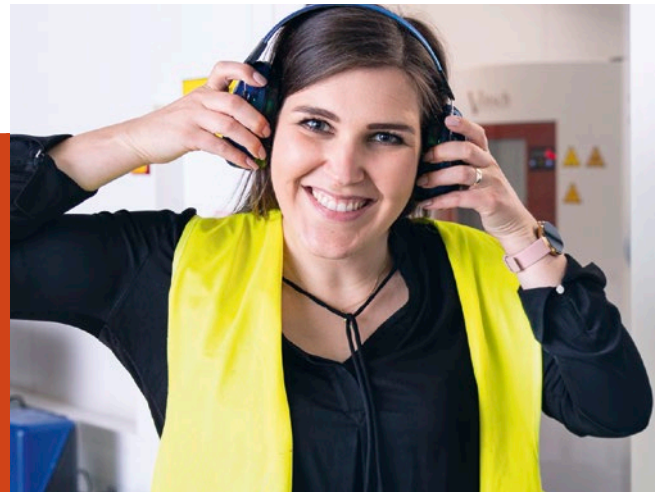
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time reading, because I wanted to identify an innovative and scientifically relevant issue,« recalls Beslic. She finally decided to focus on tribological damage to gear wheels. The fact that the damage first had to be caused before it could be analysed – in extensive series of tests – was a major challenge. It was also important to recognise the damage quickly without having to constantly interrupt the tests and remove the gear wheels. To get around these

issues, Beslic employed an acoustic testing process. »The human ear can't discern anything about the condition of individual teeth, but a frequency analysis does tell you what you need to know.« Based on her findings, and with the support of her institute, she developed a process that enables a gear to be switched in a way that minimises the stress on any teeth that are already damaged – a process that has since been registered for a patent.

By 2018, Beslic had almost tied up her project and was looking to make her next career move. She opted to join SEG Automotive, a Bosch spin-off and supplier of starter motors that had shifted its focus to electric traction motors. »In the meantime, I had realised that alternative powertrains would ultimately account for a large section of the market,« she explains. »I want to be part of this change process and, like SEG Automotive, which also has its origins in conventional powertrains, I want to help shift attention towards electrification.« In this role, Beslic uses her expertise to boost the reliability of electric powertrains. Because the damage mechanisms in electric powertrains are changing, Beslic spends a great deal of her time developing appropriate validation methods and test strategies. This is the only way of ensuring that, at the end of the development process, the product meets all the requirements of a long life on the road.

Beslic had only been at SEG Automotive for just over two months when her department manager, Dr. Dieter Eppinger – who also heads the Strength & Tribology planning group at FVV – sent out an email requesting ideas for new FVV projects. The young engineer responded with the suggestion of investigating the lifespan of coil insulation in electric motors. This was a topic of great importance; after all, even a minimal amount of damage to the insulation could cause a short circuit, resulting in the complete failure of the electric motor. Beslic attended the FVV planning group meeting in which a decision was made on the proposal. The majority voted in favour of her suggestion, but



**DR.-ING. ZELJANA BESLIC,**

born in 1988, graduated from the University of Stuttgart with a degree in mechanical engineering. Her doctoral thesis focussed on modelling tribological damage degradation on gear wheels in vehicle gearboxes. The reliability and testing engineer joined SEG Automotive in Stuttgart in 2018. She is the coordinator of FVV's »Lifetime Model Winding Insulation« project launched in March 2021.





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some members rejected it because it veered away from the usual combustion engine-related topics. The project has now been running since March 2021, and Beslic herself has taken on the role of project coordinator.

On the one hand, she is enthusiastic about FVV's work: in her view, the fact that the knowledge gained from collective research is available to all is of enormous benefit, particularly to smaller companies. On the other hand, she would like to see the organisation develop a younger »spirit« and be more receptive to the concept of electric powertrains. However, there is another point that she is keen to emphasise: »I don't believe in making a radical, rapid switch to electromobility. There is no point in charging electric cars with power generated from coal.« Accordingly, Beslic supports efforts to further optimise the conventional powertrain to reduce both consumption and exhaust emissions.

Regardless of the type of powertrain, something can only be sustainable if it functions reliably in the long term. »We should always look at the entire product life cycle,« says Beslic with conviction. So it's little wonder that the engineer is fascinated by Brooklyn Bridge, a feat of engineering completed in 1883. During a trip to New York a few years ago, she asked the man who is now her husband if he could get up at the crack of dawn the next day to paint the bridge in the early morning light. //