

Personal Testimonial

Research Internship Information	
Institute: Elektrotechnisches Institut (ETI)	
Project: Condition Monitoring of Power Electronic Systems	
Supervisor: Benedikt Schmitz-Rode	Duration: May 15 th , 2024- August 15 th 2024

MINTernship Program 2024

Hello, my name is Zachary Matheson. I am currently a master's student studying electrical engineering at the University of North Carolina at Charlotte (UNCC). The Transatlantic Energy-Research Experience (TE-REx) was a great opportunity that allowed me to experience a different life across the world. The journey allowed me to get a deeper understanding of German culture and appreciate the small things that make up your day. The stay, May 15th-Aug 15th, was long; however, it is the right amount of time. In this time, it allowed my group and I to explore different areas surrounding Karlsruhe and expanding countries around Germany. The time that I spent from 9 to 17 was fully related to my research stay. The project that I spent my time on was referred to as "Condition monitoring of Power Electronic Systems" and it gave me a deeper understanding of insulated gate bipolar transistors (IGBT) and the aging effects that play a role in deteriorating the results. None-the-less, the sunset in Germany happens around 21 so there is much more sunlight to do things afterwards.

The first few weeks are the hardest as you need to adjust to the new lifestyle and changes. Being away from your normal and jumping into something new can seem very difficult; however, as time passes, the new becomes your normal. The thought of being jet lagged from the trip overseas seemed like a big deal but if you time things correctly and sleep at a normal schedule after arriving, I noticed that I had no issues adjusting to the new time-zone. The majority of the students who are a part of the MINTernship all stayed at the International Department (ID). It's like a school dorm where you stay with other students attending school from other places abroad. The place was not equipped with A/C so the first item to purchase was some sort of cooling. The mall is located down the road where they have something like a best buy; this is where I purchased a fan for about 50 euros. A cultural shock was when I went to purchase food and drinks for my stay. The stores do not provide free baggage and the shoppers are held responsible to provide their own way of transportation and storage. Since none of us knew we had to provide our own, the stores sold bags for 0.50 to carry our groceries. The Aldi store in Charlotte is very similar in this regard, but this was not expected since it is every store you will go to.

The first day of my internship went well, it required a meeting with the supervisor of the project and to understand the goal and intention. On Monday, many of the ETI students who are there doing research for their regarded bachelor/master thesis will meet in the library and discuss how the progress is and what problems they encountered. I thought this was a fascinating idea as students try to help students in a public setting. This meeting will take

roughly 10-30 minutes, depending on how many students show up and how much has happened. I have shared my ideas and problems here and other students have pitched in ideas on how to fix the issue. While doing a deep dive in literature review, provided by my supervisor, I started to get an understanding of the goal and what my approach should be. I spent a month to a month and a half working on a physical characterized IGBT device built in MATLAB code. This was the approach that my supervisor wanted; however, there was a point when there were many parameters that were unknown and considered company secret. At this point, I spent a week working on variable sensitivity figuring out what mattered and how it affected the whole output. By this time, my supervisor was on holiday for 2 weeks and we spent our time discussing over teams to figure out the next step. The next idea was to build a physical switched model in Simulink and control aging effects during simulation. This worked for the most part and when the data was reviewed and analyzed, we were able to see that the FFT of the results from real results were like the Simulink model.

While in Germany, my group and I took full advantage of our stay. If we had free time, we would wander around Karlsruhe or visit somewhere locally. This was easily done by using the DB train that travels through Germany. Many of the places that I explored were Strasbourg, Luxembourg, Saarbrücken, Berlin, München, Basel, Frankfurt, Stuttgart and the beautiful Lake Lucerne in Switzerland. These were all amazing places and most of them had brilliant architecture that you wouldn't see in the Charlotte. If I had to consider going to any of these places again, I would visit Lake Lucerne in Switzerland again. The reason I would stay here again would be the amazing scenery in which you are surrounded by mountains and greenery. For most of these places, we stayed in a hostel of some sort or if the trip was for the day, we would take the train back late. Staying in a hostel is very inexpensive and something I would recommend any student in the future taking part in the MINTernship program to take full advantage of. Since we didn't want to spend all the money on travel expenses, we spent most of our time locally in Karlsruhe. There are many events on weekends such as concerts and festivals with food and drinks for enjoyment. If the event is correlated with KIT, food stands will typically take your KIT ID and use funding that you placed on it.

In summary, I would highly recommend that anyone seeking a research abroad position consider this program. Personally, this was my first time in a foreign country, and I felt safer traveling here than I would typically in the states. Everything is connected by the DB train and the 50-euro Deutschland ticket allowed us to travel using many of the regional trains. The support that I received from the ETI community was immense and overall, I feel like I learned more about being in a research-oriented position. The social and cultural knowledge gained is something I will use in the future when I decide to travel overseas again. This experience I had with friends from UNCC and the newly gained friends from KIT is something I will remember for the rest of my life.

Sincerely,

Zachary Matheson



