

# **Practical internship**

## **SS 2006**

### **in Detroit/America**

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## Preface

My name is Ellen Hinrichs and I am a Mechanical Engineering student at the University of Applied Sciences in Wolfenbuettel.

During my study I completed a six months practical internship at EDAG Inc. in Detroit/Michigan/USA.

This final report for CDS Intl. is about my experiences and impressions that I gained in America.



## 1. Personal Aspect

### 1.1 *Cross-cultural differences*

First of all: you can hardly compare the German life with the American one. Both are completely different! This might be some kind of strange if you have never been to America before. But if you accept the differences and all the new circumstances then you can have a lot of fun in this huge country!

This is what I experienced:

The typical American citizen is a very friendly and open minded person. Whenever you need help, you will get it. You will always feel very welcome and wherever you are, everybody has got time for a short chat. A lot of persons say that the Americans are superficial but I for myself think that they just have a basic friendliness that you would not find in Germany. It has never been so easy to get a small talk than in America. Sure - this might be superficial, but it is anyway very friendly.

Another aspect of the Americans that I like is that they know how to motivate their colleagues or their own kids. They always want you to give your best and on the other hand they promise the same to you!

What else is typical for America?

The supermarkets are open 24 hours at 7 days a week. That is very comfortable if you forgot something to buy or if your time schedule allows you to go shopping only late in the evening. But be careful: if you are in hurry and you go to a big supermarket that might take a big amount of time! In America everything is huge: even the shelves of juice or potato chips or frozen food. It is just unbelievable. If you haven't seen it you wouldn't believe that there are supermarkets with 30 different sorts of apple juice. But on the other hand it is nearly impossible to find a good and healthy black bread. They just offer white bread or wheat toast as 'bakery stuff'.

In America it is allowed to offer genetic manipulated food, without marking it. Also the milk might come from animals that are fed with hormones and the consumer doesn't know it. This is some kind of scary due to the fact that nobody knows if this might effect the health of the human body. Buying food in a supermarket in America is generally more expensive than in Germany so a lot of people just go out for lunch.

Another aspect of the American way of life that I doubt is the relation towards the environment. Especially in Michigan most of the people drive a big car: pick ups with a V6 or V8 engine, SUVs or off-road vehicles are normal. Even though the gas prices are already quite high nobody cares about it. Also the CO<sub>2</sub> emission is nothing to worry about. Generally the interstates are really dirty and something else that seems strange to me is that you can see everywhere old cars that are standing on private properties with oil leaking into the ground.

I also realized that the people are very wasteful with water but above all - the biggest energy consumers must be the millions of air conditions.

A way more frightening aspect is the matter of fact that nearly everybody is allowed to own a weapon legally. This scared me during the first weeks but after a while I forgot to think about it. From time to time you will be reminded through news that somebody is shot again or that children get hurt accidentally by weapons. I tried to avoid danger for example by going to the supermarket only during daylight but you can never be 100% sure.

Last but not least a very significant difference between America and Germany is the way of the news report. It is nearly impossible to hear news from the rest of the world but on the other hand you can always get information about the football or basketball results.

## ***1.2 Cultural activities during free-time***

A lot of people who hear the name 'Michigan' think of a state with millions of cars developed by the huge automobile industry that is situated in this region. They probably also think of the huge city Detroit - the 'Motocity' with it's deserted downtown or the Detroit Pistons.

But Michigan isn't only that. Michigan is beautiful! It has the longest freshwater shoreline in the US, the longest total shoreline after Alaska. This state has so many lakes inside that the people say that you are never more than 6 miles away of natural water source. And this makes the country so special. Whenever it is possible the people spend their time outside, best at a lake.

I did a lot of trips to some wonderful places of Michigan, for example to the 'Sleeping Bear Dunes', the 'Torch Lake', or the 'Big Sable Point Lighthouse'.



*Sleeping bear dunes*



*Lake Michigan behind the dunes*



*Marshmallows at Lake Michigan*



*Lake Michigan*



*Torch lake*



*Torch lake*

*Big sable point lighthouse*



I also did lots of trips outside of Michigan: for example to Toronto, the Niagara Falls, to Chicago or New York.



*Toronto*



*Niagara Falls*



*Chicago*



*NewYork*



*NewYork*



*NewYork*

Some interesting events during these six months were a basketball game of the Detroit Pistons, the Woodward dream cruise and of course the soccer world cup in Germany.



### **1.3 Language Acquisition**

If you want to improve your language skills you can find no better way to do it than a stay abroad. Especially the spoken English will be practised permanently because you **have** to talk.

I was very shy at the beginning: is my English good enough or will I do bad mistakes? Will they even probably laugh about me? Will I be able to understand everything? What shall I say at the telephone? It was some kind of exhausting during the first weeks, but this became better from day to day.

Now I can say that the daily small talk is absolutely no problem for me. Also the technical terms from work are terms that are used regularly. My colleagues were great: they explained a lot of words to me and even those words that you would never find in a dictionary. That was always a lot of fun because there were always small misunderstandings that had to be solved. On the other hand I told them German proverbs so that both sides learned at least a little bit.

I also read English newspapers and books which was not that bad than I expected it. What still is very difficult to me is listening to movies or news. The news are more easy because the language is clear and good understandable but if actors in the movies don't speak clear, too fast or with slang I can hardly understand them. (Perfect would be a subtitle in English).

In America it is important not to be shy: just try to talk, go ahead and you can be sure that no one will laugh at you. On the other hand I missed sometimes a little bit more corrections just to make sure that my English is not totally wrong.



## **2. Professional Aspect**

### **2.1 EDAG – The company**

The company Engineering & Design AG (EDAG) is a full-service providing supplier which is mainly active in the automobile industry. It offers integrated development and project management for all kind of manufacturing facilities. From design to technical development, model and prototype design to turn-key manufacturing facilities, EDAG is able to take really complex projects through the entire development process all the way to serial production.



### **2.2 Description of my responsibilities**

I worked during my internship in the CAE (computer aided engineering) department where I supported my office superior with preparing CAD (computer aided design) models for the FEA (finite element analysis).

A common use of FEA is for the determination of stresses and displacements in mechanical objects and systems. However, it is also routinely used in the analysis of many other types of problems, including those in heat transfer, fluid dynamics and electromagnetism. FEA is able to handle complex systems that defy closed-form analytical solutions.

The FEA uses a numerical technique called the finite element method (FEM). In its application, the object or system is represented by a geometrically similar model consisting of multiple, linked, simplified representations of discrete regions—i.e., finite elements on an unstructured grid. Equations of equilibrium, in conjunction with applicable physical considerations such as compatibility and constitutive relations, are applied to each element, and a system of simultaneous equations is constructed. The system of equations is solved for unknown values using the techniques of linear algebra or nonlinear numerical schemes, as appropriate.

While being an approximate method, the accuracy of the FEA method can be improved by refining the mesh in the model using more elements and nodes.

The Finite Element Method is widely used in the automotive-, aircraft- and aerospace-industry. It has a number of advantages that have made it very popular. It includes the ability to

- model irregularly shaped bodies quite easily
- handle general load conditions without difficulty
- model bodies composed of several different materials because the element equations are evaluated individually
- handle unlimited numbers and kinds of boundary conditions
- vary the size of the elements to make it possible to use small elements where necessary
- alter the finite element model relatively easily and cheaply
- include dynamic effects
- handle nonlinear behaviour existing with large deformations and nonlinear materials

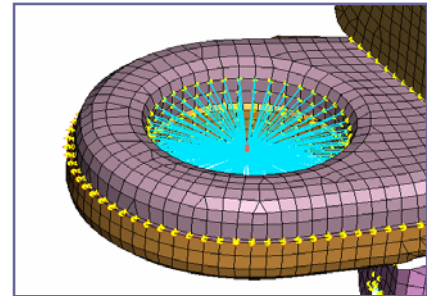
The finite element method of structural analysis enables the designer to detect stress, vibration and thermal problems during the design process and to evaluate design changes before the construction of a possible prototype. So **it can**, if used properly, **reduce the number of prototypes that need to be build.**

The normal process chain in the FEA consists of pre-processing (preparing the data), solving (running the solution algorithms, which involve the solution of simultaneous equations) and post-processing (analyzing the results).

## My responsibilities

My main tasks at EDAG Inc. were to prepare the CAD models for the analysis (pre-processing) and that means: the models have to be overlaid with a mesh. Depending from the type of analysis, as there are: crash-, noise-, vibration-, harness- (NVH), fluent- or durability-analysis, the mesh size and mesh type vary.

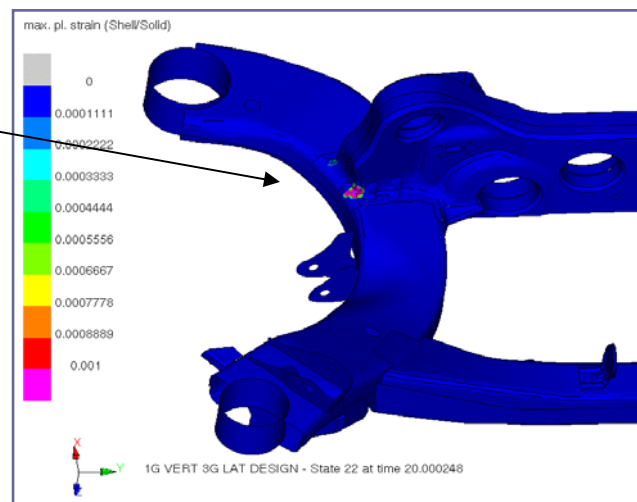
Noise vibration harness (NVH)	25mm
Crash	>5mm
Fluent	depends on where the auto-parts are located front area: 1-3mm back area: 10-15mm
Durability	10mm



*Mesh size: 10 mm*

After meshing the parts they are ready for the solver program. The solver program is able to simulate different kind of applied forces, different frequencies etc. And after this comes the post processing.

This example shows that in the corner of the cradle a maximum plastic strain of 0.02% occurs. This might mean that the design of that area has to be changed - if the requirements are not fulfilled.



*Picture of the post-processor 'Animator'*

The work during my internship with EDAG Inc. was quite interesting. The FEA might detect problematic areas before the first prototypes are built and this is just cost effective for the company that develops the parts.

### **3. General comments**

#### ***3.1 How will I apply what I learned during the program in my home country?***

I think that I can take a lot of conclusions out of this internship abroad. A stay alone in a foreign country abroad gives you a lot of independency as well as self confidence. Both are very important characteristics. I hope that I can keep those for a long time.

To me it is also important to be responsive to other people's problems and to keep the openness towards foreign people. I will try to represent my home country towards them as good as the Americans did with their country.

I am proud to be German and now I know that this is nothing bad. I can show this!!

#### ***3.2 Would you recommend this experience to your friends?***

Yes, absolutely! This is such a fantastic experience that everybody should do. Beside the personal enrichment there is also a plus for your professional future. I was able to gain a valuable sight into the working area of the company EDAG Inc. within the automobile industry. The experiences of my work are very helpful for my future activities.

A stay abroad is nowadays nearly everywhere a requirement and if you have already made an experience like this I am sure, then you can handle this challenge anytime again. It is not always easy but you get wonderful and precious experiences!

### **3.3 General comments**

This internship abroad was a very precious experience and I am proud that I made it. I want to thank Inwent and CDS Intl. for all their help and support. The organisation was professional and very helpful.

But of course I also want to thank all my friends and colleagues at EDAG Inc. that I met in America. They made this stay so special and they made me feel good in this huge America. They showed me the American way of life, they answered all my questions and they brought their mentality close to me.

I am sure I will go back again to see more of this beautiful country with its friendly people.