

To Enrich Life –
My journey & the finite element method

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Positive attitude

Responsibility

Initiative with **I**ntegrity

Determination

Enthusiasm

A **PRIDE** to strive for ...

... displayed on a poster in my M.I.T. office for many years

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Preface

I wrote earlier the short book "To Enrich Life", which focused on my life. I obtained a most wonderful response of appreciation by the readers of the book with which I am naturally very pleased. However, although I strived to contribute to the development of the finite element method, the book contained little information on how the method was created and is now used – a subject I realized to be of much interest to engineers and scientists using the finite element method.

Hence, I decided to write this new book, based on the above short book and add new sections with the objective to focus on my journey in life and my observations regarding the creation and development of the finite element method. My professional life journey is interwoven with how the modern finite element method was created and advanced.

My life can be thought of as a journey of two parts. In the first part, called Part I in the book, I describe how I grew up in Germany after World War II, left Germany for South West Africa (today's Namibia), went to South Africa to work in a gold mine and road construction, and finally studied at the University of Cape

Town, UCT. Based on my experiences during these years I established the values and wishes for my life. For these early years, I will therefore tell many personal events which formed my values, attitudes and ambitions, and laid the foundation in me to go out and try to enrich life — my life and the life of others, all within my modest capabilities.

Therefore, in the second part of my life journey, described in Part II of the book, I focus on my graduate studies and my professional career, being a Professor at M.I.T. and helping my company ADINA R & D. This includes my trips and engagements. I focus on the positive aspects that I have experienced in my life, and for which I have been very blessed; but I also mention that I tried to look at any difficulty as a challenge to overcome, and a possibility to grow mentally and spiritually in my life. In some cases, however, I also lived in denial which was not always good but gave me happiness.

In the last part of the book, Part III, I first describe how the finite element method was created in the 1950s and early 1960s, and how then the method rapidly became a research focus in the late 1960s and 1970s. In this description, I only present my perspective which is based on my reading, research, my activities and my encounters

with many people. I then focus on how the finite element method started to flourish since the late 1970s, and how the use of finite element methods, also referred to as computational engineering, has greatly enriched our lives. Hence the creation, development and eventual wide use of the finite element method is described. Thereafter, an outlook into the future is given.

In the last chapter of the book, I describe how I tried to build happiness and give a quite personal view.

Today, most adults have seen bridges, cars, airplanes, high-rise buildings, cell phones, medical equipment and frequently know a little about Robotics and Artificial Intelligence, but too few people know about the finite element method. And yet this method has played and continues to play a major role in advancing many technologies including those mentioned above. An important objective for writing this book is to tell in a non-technical manner about the finite element method which in many respects provides today the foundation for numerous widely known achievements in engineering and the sciences.

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Part I
My Early Life — the Formative Years

Chapter 1 Growing up in Germany

Having been born during the Second World War, my very early years were a special challenge for my mother and father, and then as we got older, for my brother, sister and me. The challenges that we had as children imbued good qualities in us with which I could make efforts and build a happy and fulfilling life.

1.1 My Infancy

I was born in May 1943 in the middle of World War II, in Berlin, Germany, two years after my brother Volker, and six years prior to my sister Ingeborg. I remember nothing of the Berlin at that time. All I can recall of my very early years is what my dear mother told me over many years at a later age.

My mother told me that I was a very quiet baby. I hardly cried and mostly slept. During these years of the war, Germany proper and the German occupied lands were of course under attack. And one day, in Lissa, today's Leszno in Poland, my mother had forgotten that her quiet baby was still in the garden in the baby carriage. I was sleeping in the garden during another airplane attack and did

not wake up. That seemed to have been many times the case, but my mother was thereafter more careful.

This ability to sleep soundly even when severe events occurred did not last many years. While I certainly could, and would, take a lot of pressure later in my years, my ability to soundly sleep through “pressured times” vanished.



Our parents with Volker, left, and me

My mother focused all her efforts on her two children in Berlin while my father had been sent to the Russian front. My

grandmother from my mother's side died in Berlin from hunger.
Of course, I cannot remember her. Her husband, Günther Martini,



My grandfather Günther Martini

my grandfather left Berlin and finally found refuge in a small village, called Dinklar, near Hannover. He had been a high-ranking Navy officer during World War I but retired from the Navy and became a journalist well before Hitler came to power. I always admired my grandpa. He had been a very successful officer with commands over many ships during his career. I still remember photos of about a dozen ships he commanded, photos that my mother inadvertently lost or discarded during one summer while I was traveling, far from home.

What perhaps impressed me most, already in my young years, was that my grandpa Martini loved the German people, and was very much against Hitler and the Nazis. In fact, he warned “that Hitler will do bad, very bad”. How right he was! What excellent foresight he had!

My grandpa Günther Martini was responsible for many lives in the Navy in the war, and was a very good person, a true Christian with his heart full of gratitude for life and kindness to others. I remember that one of his ships sunk during the First World War. All the people on the ship had to abandon the vessel and he saved someone’s life who clung onto one leg of my grandpa for hours as

they struggled to stay alive in the frigid water until help arrived. My grandpa's leg never fully recovered.

I also still have the original letter that my grandpa wrote to my mother on June 21, 1950. He wrote about his life in Dinklar and also mentioned that he is rather weak, and includes the words (translated from German) "... it may not be long anymore before God Almighty will call me. I am ready." He concludes the letter with "God bless you and your loved ones".

The major point is that a person serving in the military can, just like any other person, be a good person in her/his heart and by actions.

On my father's side, my grandpa died as a young person, and I only saw pictures of him. He had been a high school teacher, and had obtained a doctorate, which in the early 1900s was a tremendous achievement. His wife, my grandmother, was a very quiet, religious and thoughtful person. I developed a very special relationship with her, as I shall describe later.

It was important that my mother and father made great efforts to bring up their children as good religious people. We were baptized