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# André-Louis Cholesky

Mathematician, Topographer and Army Officer

 Birkhäuser

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Photo on the cover: André-Louis Cholesky © Cholesky's family

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... [1]a misera vita non trapassi senza ... lasciare  
di noi alcuna memoria nelle menti de mortali ...  
*... the miserable life should not pass without ... leaving  
some memory of ourselves in the minds of mortals ...*

Leonardo da Vinci  
Codex Urbinus, Vatican



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## Preface

The name of Cholesky is well known in two communities of scientists: applied mathematicians and topographers. Any applied mathematician knows Cholesky's method for solving certain systems of linear equations (see Chapter 4). Ask an applied mathematician who Cholesky was. Maybe, she/he will know some details about his life since, for some years now, information has been provided on various forums and biographical papers have been published (see the bibliography at the end of the book). Cholesky's method is also used by topographers who have to solve such linear systems when applying the least squares method for minimizing the sum of the squares of the errors. But topographers also know Cholesky for his method of double-run leveling (see Section 3.3). If you see one of them in the street, ask him if he knows this name. At least in France, the answer is always yes, but his biography is usually unknown. This method is still taught nowadays, and it can be found in modern textbooks on topography; see, for example, [117]. Putting his name (also with the spelling Choleski) into a search engine on the internet returns several hundreds of thousands of pages.

The genesis of this book was quite a long one. Some ten years ago, not many details were known on the life of Cholesky although his biography, in fact an eulogy, was published in French in 1922 [41], and was translated into English in 1975 (see Section 8.3). But this biography did not circulate much and, from time to time, questions were asked on internet forums. It was mainly known that he was a French officer, that he was born in 1875, and was killed at the end of World War I. The only detailed information we had came from *École Polytechnique* in Paris where he had been a student. But they were restricted to the marks he obtained at the exams there. In France, a law stipulates that personal archives are open to the public 120 years after the birth of that person. Thus, 120 years and one day after the anniversary of Cholesky's birth, I went to the archives of the Army at the Fort de Vincennes near Paris where I was able to access all the documents about him [2]. Then, I wrote a first biography on him [52]. After the publication of this paper, Yves Dumont, at that time a professor at the *Université de la Réunion*, built a web site on Cholesky.

Then, in 2003, Claudine Billoux, the archivist of *École Polytechnique*, received a phone call from a grandson of Cholesky. He was calling to say that the family was willing to donate the archives in their possession to the *École Polytechnique*. However, he asked that the materials be picked up as quickly as possible, otherwise he would be obliged to throw them away. The problem for Mrs. Billoux was the volume of these documents: one cubic meter. But they were in Bordeaux, in the southwest of France, and the budget cuts made it difficult to rapidly obtain a car and a driver. Fortunately, another grandson of Cholesky, Michel Gross, was able to bring the papers to his house near Paris. He also offered to help in classifying these archives. However, although an engineer, he was not a mathematician and he contacted Yves Dumont who directed him to me. Thus, I was quite sur-

prised, in December 2003, to receive a letter from this grandson informing me that the family had given all the documents to the *École Polytechnique* and asking if I could help him and Mrs. Billoux to classify them. Of course, I accepted and we almost immediately found the unpublished manuscript where Cholesky describes his famous method for solving systems of linear equations [46].

From what can be known, the documents constituting now the *Fonds André Cholesky* which is at *École Polytechnique* were given to his widow after the death of Cholesky on the front in 1918. After the death of the latter, in 1944, these documents came into the hands of one of his daughters, Hélène, who lived in Morocco and had her mother with her for several years. In 1945, Hélène and her family moved to Bordeaux where the documents remained until 2003. According to the recollections of the grandchildren of Cholesky, none of these documents were exploited by the family during the time they were in her possession. At most, they aroused the curiosity of the young children of the family who found it fun to fill in some military blank forms.

With Michel Gross, we classified all these documents and published papers relating our discoveries in the *Bulletin de la Société des Amis de la Bibliothèque de l'École Polytechnique* (see the bibliography at the end of the volume, in particular [59, 86]). In October 2005, I was invited by Dominique Tournès to give talks, one of them on Cholesky, at the *Université de la Réunion* where he was (and still is) a professor. Then, in 2010, I was contacted by Frédéric De Ligt, a professor of mathematics and the president of the *Association des Professeurs de Mathématiques de l'Enseignement Public* of the Région Poitou–Charentes who invited me to give a talk on Cholesky at the Lycée Bellevue in Saintes. Frédéric was living in Montguyon, the native town of Cholesky. He brought me a book on the history of the city of Montguyon written by Raymond Nuvet, the vice-mayor of this city where some details about the family of Cholesky were given. I contacted him and this is how the search for a more complete genealogy of the family started.

After that, I returned many times to the archives of *École Polytechnique*, alone or with Dominique Tournès, for digging into the documents left by Cholesky. Since Dominique is a well-known historian of mathematics and a specialist of graphical computations, I asked him if he was willing to collaborate with me on the project of this book, in particular on an unpublished manuscript of Cholesky on graphical calculation.

Cholesky's method for solving certain types of systems of linear equations is known worldwide. It is taught to all students in applied mathematics and numerical analysis, and can be found in any book on these topics. In Section 4.7, we will see how it was disseminated. Let us only say now that Cholesky never published his method himself but that it was solely known from a paper, written by a Commandant Benoît, six years after Cholesky's death [42]. In the documents his family gave to *École Polytechnique*, as said above, Michel Gross and I

almost immediately found the autographed manuscript where Cholesky described his method. This was the beginning of a great adventure.

On 1 September 2012, the name of André–Louis Cholesky was bestowed on the new cultural center of the city of Montguyon, where he was born, following a proposition of Raymond Nuvet (see the picture on the last page).

Cholesky's biography is the topic of Chapter 1. The information on his family, gathered in great part by Raymond Nuvet, is given in Chapter 2. Chapter 3 explains some generalities on topography and describes the work of a topographer. Chapter 4 is dedicated to Cholesky's method for systems of linear equations. Other works by Cholesky are reported in Chapter 5. Chapter 6 is devoted to Léon Eyrolles and the high school that he created where Cholesky was a professor. As I said above, we also found in the archives an unpublished book by Cholesky on graphical computations. In Chapter 7, Dominique Tournès comments this course, analyzes it and places it in its historical context. He also edited the book that is reproduced for the first time in Appendix C. Chapter 8 is devoted to Benoît. Various documents are in Chapter 9. The paper by Cholesky, reproduced in Appendix B, and his book transcribed in Appendix C by Dominique Tournès, belong to the *Fonds Cholesky - École Polytechnique* which holds their copyright. We were given the authorization to use all the documents it contains. A chronology of the life of Cholesky, a bibliography, and an index (where the family name *Cholesky* is not included) end the volume.

Sometimes, my translation from French may be not as accurate as I would like. However, I did my best to keep the general meaning of the text and the style of the authors. Quotations are in italics. I would like to apologize in advance for all errors and omissions the book could contain. They are all mine.

Claude Brezinski

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