AN INTERVIEW WITH

Alfio Quarteroni

by **Gonçalo Pena***

Alfio Quarteroni (born 30 May 1952) is Professor of Numerical Analysis at Politecnico di Milano (Italy) and Director of MOX. He is the founder of MOX at Politecnico di Milano (2002), the founder of MATHICSE at EPFL, Lausanne (2010), the co-founder (and President) of MOXOFF, a spin-off company at Politecnico di Milano (2010). Co-founder of MATHESIA (2015) and of MATH&SPORT (2016).

He is author of 25 books, editor of 5 books, author of more than 300 papers published in international Scientific Journals and Conference Proceedings, member of the editorial board of 25 International Journals and Editor in Chief of two book series published by Springer.

Among his awards and honors are: the NASA Group Achievement Award for the pioneering work in Computational Fluid Dynamics in 1992, the Fanfullino della Riconoscenza 2006, Città di Lodi, the Premio Capo D'Orlando 2006, the Ghislieri prize 2013, the International Galileo Galilei prize for Sciences 2015, and the Euler Lecture 2017.

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What took you to choose Mathematics? Was it a calling or pure chance?

It was (almost) pure chance. After my high school diploma I was supposed to start with my first job of bank accountant. It was indeed the president of my diploma committee who urged me to continue studying. I didn't have any specific education in Math (my high school was a technical one) and I wanted to challenge myself with a tough subject I didn't know almost anything about. It was, indeed, a rather irrational move, but I had somehow the feeling that Math would have become important for Economics, the subject I really loved at that time.

When did you decide to study Numerical Analysis and Scientific Computing?

At the end of my third year at University I asked Enrico Magenes, a famous analyst in Pavia (my university) a subject for my Laurea (today we would call it master). Professor Magenes redirected me toward Franco Brezzi, a very young researcher although already quite famous in the field of finite element theory. That was my start with Numerical Analysis. My passion for scientific computing and applications came later on.

Whose work on (applied) mathematics do you admire the most? A book you read, a paper?

The book by Jacques Louis Lions *Optimal control of systems governed by partial differential equations*, Springer 1971 (not only for the optimal control theory) and that of Isaacson and Keller, *Analysis of Numerical Methods*, 1966 (my first book in numerical analysis).

You work on an area that bridges scientific computing, simulation and mathematics (which is quite a feat!) What are your thoughts on the difference between pure and applied mathematics, if there is any?

There is just one mathematics. There are, however, pure and applied mathematicians. The former go as deep as possible into the matter, to reveal the secret of mathematical structures. The latter face a real life problem and have to develop (or use) the best possible mathematics to solve it; simplification is admissible, provided however it does not change (or disregard) the essential feature of the solution.

Throughout your career, you worked in many interesting projects (like the Alinghi yacht or Solar Impulse).

I won't ask you to pick a favorite, but what attracted you to each of them?

I must admit that I was always warmly asked to work on those problems (and many others). I accepted those which fascinated

me, I left apart those that were less original (or challenging).

I know you travel quite a bit, especially when you were working in MOX and EPFL. How did you keep up with such a tight schedule?

No answer. It comes like that.

What hobbies do you have (besides travelling)? Favorite book?

I loved playing soccer and tennis when I was young. Now I am still a soccer fan. I do not practice any sport, unfortunately, apart from swimming (but not regularly). I walk a lot, I read reasonably often: novels, science-fiction, non-fiction, books on history. I love listening music, any kind of good music (rock and classic music).

This is not your first time in Portugal or Coimbra. Do you recall your first visit here? Can you tell us a bit about it?

I came in 1997 for an International Conference in Lisboa organized by Adelia Sequeira, then in 1999 in Coimbra for an internal summer school where I gave a series of lectures, then again many times in Lisboa, Coimbra, Porto and Madeira. My very first impressions were that there was a special light in the sky and full of colors in the building and a great similarity between Portuguese and Italians. Fantastic food, warm

hospitality, a great cultural heritage, and a great talent in the young people. A place to be.

What do you find most interesting in our country and what do you like the least?

See above for the plus. On the negative side, it is sad to see how many Portuguese are not in their home country. This is a great loss for Portugal. (Italy is experiencing the same diaspora, especially in the last 20 years)

When I was a student at the University of Coimbra in 2000 (The World Mathematical Year), you came here to talk at a conference addressed to a general public and I was very impressed with everything you presented. Do you realize the impact you have, not only on mathematics, but on the people you talk to at conferences? Have you ever felt that you also have a kind of mission in the way you communicate mathematics?

I still remember that event. Paula Oliveira invited me for the conference *Teias matematicas*. I believe mathematics has not the place it deserves, especially among the students at primary and secondary schools. I am often invited to make presentations to high school students. I want to convince them that Math is not less important than Physics, Philosophy or Chemistry, say, and does have a great impact on our lives. There are too

many brilliant students who do not enroll in Math just because they have never been exposed to this kind of arguments, even though they are (potentially) very good in Math. I like presenting major math achievements in order to convince them that they can be a mathematician and be proud of that.

I've also been one your PhD students and noticed the strong group bonds that were built. What do you think is the key to a good work environment?

I believe that the major responsibility of a PhD advisor is to provide constant source of new and interesting problems to his/her students (and to show the horizon). Also, to create a warm and stimulating work environment, and the right opportunity for everyone for knowledge exchange.

Which advice would you give a young research starting their PhD now?

Being a researcher is the best possible job in the world. This is absolutely true: I am old enough and experienced enough to guarantee that this statement is true. Competition, however,

is tough. You must be motivated and ready to experience frustration (when results do not come as expected: there is no low-hanging fruit in our business) but also excitement. You need to be patient: it takes time and sacrifice before the right job opportunity materializes. It is also important to work on a challenging and timely subject.

It's clear Mathematics helps to shape the world and it's a fundamental tool in its development. Which challenges do you think lie ahead for the next 20 years?

Providing a sound, rigorous and general mathematical theory to AI and machine learning, helping doctors to improve personalized healthcare through mathematics and improving our mathematical understanding of climate change and the social effect of people's migration

If you were not a mathematician, what do you see yourself doing in your professional life?

A farmer. My very first job, long ago.