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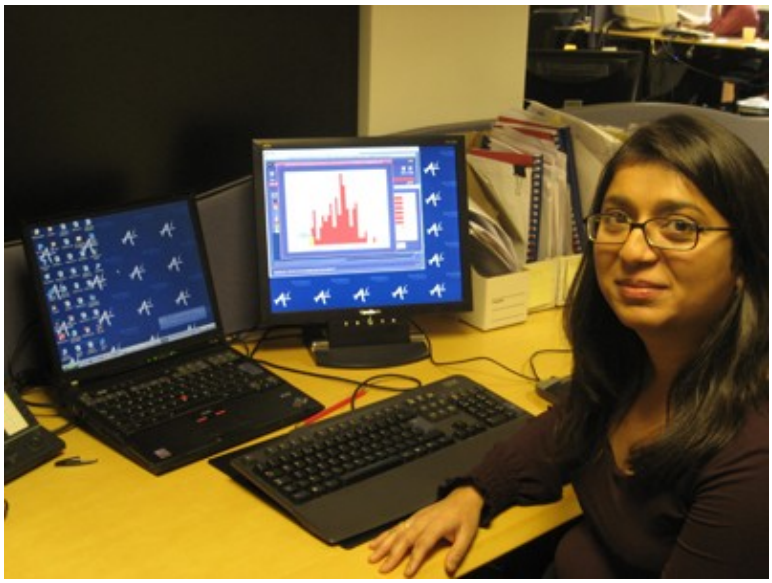
Features

# Career interview: Financial Engineer

## by Marc West





Rupa Patel

"I was one of the lucky people," said Rupa Patel, reflecting on her childhood. "I knew I liked maths from a very early age."

For Rupa, maths was never hard work  indeed, it was something that she always enjoyed doing.

"Even going back to primary school, I was good at it. To do maths wasn't like a chore, it was something I

always enjoyed. Mathematics was always a big part of my life, it was me, it defined very much the person I was. I was terrible at English and languages so that kind of made up for it (laughs)."

A career in mathematics beckoned for Rupa, and today she works as a financial engineer with the very mathematically named Algorithmics Ltd. Although she has worked with Algorithmics for ten years, it wasn't financial maths, but teaching maths, that initially intrigued her.

"My natural instinct was telling me to go into teaching. At secondary school I was lucky enough to have some very inspiring maths teachers. Sometimes my teacher would let me run the class she was a Polish teacher and sometimes her English wasn't brilliant, but I could understand her and the rest of the class could understand me. Whilst I was doing my A−levels, I would do some teaching of the younger classes with the teacher, to get the extra help and some experience as well."

University, however, opened Rupa's eyes to the many possible opportunities available to those with mathematical skills. After following what felt like a natural progression from degree to PhD, Rupa started to consider her options, and caught a glimpse of the bright lights and financial rewards of the finance industry although it wasn't these factors that she was attracted to.

"I didn't really start to think too much about careers until quite late on. During my PhD I started to look at my options a lot more. Finance interested me, it was something business−like and practical, and it was a different way of using the mathematics that I had learnt."

The mathematics she studied was fluid dynamics at Imperial College London. Her PhD was entitled *Non−linear vortex wave interactions* and examined airflow across a wing. This background provided a very strong mathematical footing for her work in financial maths, as many of the finance equations are either the same, or very similar, to those she used in her PhD. Fluid mechanics involves solving partial differential equations, and these equations are mirrored in financial maths.

"One of the main formulas that we use is the Black−Scholes equation, which is a pde (partial differential equation), and you can transform that back to the heat equation that you use in dynamics and applied mathematics. All the methods for solving the heat equation, you can then apply to the Black−Scholes equation, which is used for pricing options. So it's actually very beautiful mathematics that's one of the fantastic things about maths, everything is beautiful when you write it on a piece of paper."

Working in financial maths has the added bonuses of allowing Rupa to look back at her old fluid dynamics notes for help, and access to advanced computing facilities that are far better than those she had at university.

"Everything I have come across in my financial maths, I can look up a reference to in my old mathematics notes the equations are very similar and the methods of solving are similar. And the great thing about working with a company is that you have computer equipment you can be on the cutting edge of it. You can use highly computational methods to solve the equations."

Financial mathematics appealed to Rupa also because it was relevant to real life "everyone has investments or pensions" but she was apprehensive at first, having never had any business experience. In the end, however, the fact that it was a new field with new terminology and practices has meant that Rupa now finds her work quite exciting. She also enjoys being exposed to a range of clients who each require something different from Algorithmics. Nevertheless, she has not lost that pure mathematical desire:

"I try to sneak days where I sit at home and go through the maths in a bit more detail. I think I have a nice balance at the moment."

Rupa's work at Algorithmics involves producing risk management reports for companies within the finance industry, such as banks. She explains that the two biggest forms of risk in her work are market risk and credit risk. Market risk is the risk that the value of an investment will decrease due to market factors such as stock prices or interest and exchange rates falling. Credit risk examines the loss that you make if your counterpart in a deal defaults on their payments to you.

"If someone owes you money and they don't pay you back, then basically you've lost the money. So, it is very important for us to have mitigation techniques  ways to reduce our credit risk, and also to measure our credit risk."

Algorithmics produces its own software suites to create risk management reports. The work is highly mathematical and "very much what one would study in a financial mathematics masters degree." A practical example is the calculation of the *Value at Risk (VaR) number*  the maximum loss not exceeded by a company within a certain confidence interval. A confidence interval is a range of values, so that the loss is within that range with a certain probability, usually 95%.

"The great thing about the VaR number is that everybody understands it  it's one number that you can calculate and it tells you what your possible loss could be."

Another interesting example of her work is *stress testing*  creating a catastrophic scenario in which everything goes wrong, and seeing what happens. This involves simulations of what the market might do under such circumstances, and this is often achieved by running Monte−Carlo simulations. Such calculations involve running the same simulation over and over again with various variables in the simulation randomly changed in each run. The overall result is the average of all simulations with an additional error term. "Every bank simulates 9/11 and sees how the market reacts."

Algorithmics sponsors risk management courses around the world, including one that was run at University of Cambridge. When I asked Rupa whether therefore she got to travel and see the world, she made me quite jealous: she had been to Athens, Israel, Stockholm, Helsinki, Italy, Paris and even Estonia. This is one part of her job that Rupa loves  being able to interact with others and see how they conduct their work. This is not surprising considering her earlier passion for the teaching and communication of maths throughout school and university.

"It's quite nice to see how companies operate across Europe. The Northern European countries are very strict, work on tight lines and don't seem to take breaks, whereas the southern Europeans seem a little bit more relaxed. But still the financial knowledge across all of those regions is the same. Everyone's talking the same language when you're talking of a model. Everybody across the different banks and financial industries has effectively the same handbook, so it's interesting to talk to different clients about how they use these models and what their approach is to creating their business requirements. So the job involves a lot of travel but you learn a lot from talking to other people."

Is the moral of this story to study maths and see the world?

Perhaps, or as Rupa put it: "If you want to keep your options open, maths is a fantastic degree to go into."

## About the author

Marc West is Assistant Editor of Plus.


*Plus* is part of the family of activities in the Millennium Mathematics Project, which also includes the NRICH and MOTIVATE sites.