

# Ask an Acoustician: Zoi-Heleni Michalopoulou

*Zoi-Heleni Michalopoulou and  
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## Meet Zoi-Heleni Michalopoulou

This “Ask an Acoustician” essay features Zoi-Heleni (Eliza) Michalopoulou from the Department of Mathematical Sciences, New Jersey Institute of Technology (NJIT; Newark). Eliza is a member of the Acoustical Oceanography, Acoustical Signal Processing, and Underwater Acoustics Technical Committees of the Acoustical Society of America (ASA). She is a Fellow of the ASA and has been a member of the College of Fellows, cochair of the Women in Acoustics Committee, and an associate editor for *The Journal of the Acoustical Society of America*. I will let Eliza tell you the rest in her own words.

## A Conversation with Zoi-Heleni Michalopoulou, in Her Own Words

### *Tell us about your work.*

I listen to the ocean! Employing both acoustic models and statistical signal processing, I conduct research in geoacoustic inversion. That is, I solve the inverse problem, estimating properties of the seabed with which the sound has interacted. The forward problem in ocean acoustics, in simple terms, entails the modeling of the sound that travels in the ocean using mathematical relationships and relying on physics; the models connect sound propagation to the location of the source that transmits the sound, the placement of the receivers where the sound is sensed, and ocean environment parameters such as properties of the sediments. The inverse problem, on the other hand, uses these forward models and recorded data to move backward, that is, to identify the properties that generated the measured sound.

Geoacoustic inversion is one aspect of the inverse problem. My interests extend to inversion for source detection and

location as well, both of which are inherently tied with geoacoustic inversion. Knowing the propagation environment, determined to a large degree by the seabed structure obtained via geoacoustic inversion, allows us to better detect, identify, and localize sources of interest in the ocean, whether these are submarines or sound-producing marine life. These tasks are of paramount importance in antisubmarine warfare and the study of marine life.

I see my work as a combination of underwater acoustics, acoustic signal processing, and acoustical oceanography, reflected in the three ASA technical committees of which I am a member. Recently, I have delved into machine-learning methods, both for sediment characterization and source localization. I am fortunate to have colleagues who share experimental data with me, which facilitates the validation of my methods in real environments.

### *Describe your career path.*

I was born in Athens, Greece. Often, when I was in elementary school, I would get together with my best friend and we would put together electrical circuits from a set that had been given to my brother as a present. I then attended Pierce College, the high school of the American College of Greece. I had the opportunity there to be exposed to a rich curriculum in liberal arts, science and mathematics, languages, and art. Math attracted me the most, and I decided early on that I wanted to do something with numbers.

As is often the case, I was told that girls are not made for math and that only made me more determined to pursue

a STEM career. I decided to study electrical engineering at the National Technical University of Athens because it was the most prestigious STEM program in my hometown; the electrical circuits of my childhood may have played a role in my decision! I enjoyed my studies and decided to continue for an MS in electrical engineering in the United States. My high-school years at the American College of Greece had prepared me for this wonderful adventure. I was fortunate to attend the MS program at Duke University (Durham, NC) where I met my advisor, Dimitri Alexandrou, who had a passion for anything that had to do with sound and the ocean. He inspired me, and not only did I complete my MS thesis in ocean acoustic signal processing, but I decided to move forward for a doctorate in the same area.

Research became a passion, which led to an academic career. I have been at NJIT ever since I graduated from Duke, starting as a research assistant professor/postdoctoral fellow in the Department of Mathematical Sciences. The environment was (and still is) full of energy and a great fit. Soon after I joined, an opening for an assistant professor position came up. It was an easy decision for me to apply and accept the offer that followed. I have been enjoying a fruitful career there ever since. I have had the fortune to meet at Acoustical Society conferences colleagues such as Ross Chapman, Alex Tolstoy, Jim Candy, Ed Sullivan, Ellen Livingston, Leon Sibul, Leon Cohen, and many others, who mentored me in my early years and to them I owe much of the satisfaction I have been drawing from my career.

### *What is a typical day for you?*

I am a morning person, and my day starts very early; I am up at 5 a.m. with a cup of coffee, reading *The New York Times* on my computer. But, other than that, every day is different. Research, teaching, and administration all compete for time. I try to get a good few hours of uninterrupted research time before delving into class preparation, teaching, and administration. I have frequent meetings with my students that I look forward to because they often lead to fresh ideas and perspectives. I draw a firm line at around 6 p.m. Family and personal time start then unless deadlines are looming. Relaxed family dinners, classes at the Adult School of my town, and reading occupy my evenings.

### *How do you feel when experiments/projects do not work out the way you expected them to?*

I sometimes get frustrated, but I try to take it as a learning experience. I look for the reason behind the failure of an idea. That usually leads to a new idea that is an alternative look at the problem I need to solve. And I try to remind myself that progress in research is not a linear process.

### *Do you feel like you have solved the work-life balance problem? Was it always this way?*

Yes, as much as this is possible. I have a supportive family and a flexible working environment. Teaching courses at convenient times and having family members help with child care so that I could attend conferences helped me attain a satisfying combination of career and family life. Having a daughter who appreciated my work and enjoyed telling her friends about her mom searching for submarines was a bonus! The flexibility of my work allowed me to get involved in the community. I served as a volunteer for my daughter's Girl Scout troop and unit, and I also volunteered at her elementary school, mostly helping students with math and science. I managed never to miss my daughter's recitals, choir events, and soccer or volleyball games. I enjoyed travel and still do, attending many conferences, often with my husband and daughter, and I get to visit frequently my family in Greece, where I also enjoy collaborations with colleagues at the National Technical University of Athens.

### *What makes you a good acoustician?*

I work in an applied mathematics and statistics department in a technological institute that enables me to have discussions and collaborations with researchers from multiple areas in the mathematical and physical sciences as well as engineering. I develop new ideas and a better understanding of acoustics problems after I become exposed to research advances in different disciplines. And I learn from my students.

### *How do you handle rejection?*

I put aside negative reviews and revisit them a couple of weeks later. I carefully consider critique (sometimes I agree and sometimes not) and try to use it to develop

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new ideas or better arguments for my existing ones. I keep going.

### *What are you proudest of in your career?*

It has been a privilege to have mentored numerous bright and talented young people, several of them from underrepresented groups in the sciences. I have had the pleasure of guiding several women in research projects, both during their graduate and undergraduate studies. I take great pride in their accomplishments during and after their time at NJIT. I follow their career paths and keep in touch; notes that they send me decorate my office. Similarly, I have found it rewarding to address middle- and high-school students and to inspire them (I hope!) about pursuing careers in STEM. On several occasions, students have approached me afterward, startled and excited about careers in math that they had never imagined.

And, of course, I am exceedingly proud of the bright 23-year-old woman that my husband and I have raised in parallel to our careers, who has often inspired me to work harder so that I could become a better role model for her and her peers.

### *What is the biggest mistake you've ever made?*

Overthinking everything. Writing a paper or research proposal was sometimes a particularly lengthy endeavor. Should I include the last figure? How about adding one more reference? And how about this email I need to send? How will I convey my message? Once I realized it, I stopped it and became more efficient and effective.

### *What advice do you have for budding acousticians?*

Enjoy the journey into a multifaceted field. Attend conferences and listen to talks from all areas of acoustics; seek collaborations and cross-fertilization. Take risks and explore new directions.

### *Have you ever experienced imposter syndrome? How did you deal with that if so?*

Yes, I did, in the very beginning of my career as a faculty member. With the advice of a wonderful colleague and

mentor, I realized that the first person I needed to persuade that I truly belonged in a challenging academic environment was myself. Everything followed smoothly after that.

### *What do you want to accomplish within the next 10 years or before retirement?*

I plan to continue with all my activities: research, teaching, and administration. What I would particularly like to accomplish is the mentoring of more undergraduate students in research. There is a spark when undergraduates are exposed to research questions and asked to work alongside graduate students, postdocs, and faculty. Several are inspired to go on to graduate school and some continuing to work in acoustics. Others tell me that their research experience and participation in research teams in their undergraduate years enables them to work more effectively in groups in their jobs in industry. A worthwhile experience all around.

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