Teaching Statement

Teaching has been an integral part of my scholarly activities throughout my career. Based on my undergraduate teaching experience and student supervision at the Department of Chemical Engineering at Imperial College London, in 2018 I have become a Fellow of the Higher Education Academy (**FHEA**), and in 2019 was officially recognised as **Assistant Supervisor**.

I have teaching experience at various levels, including one-to-one tutoring, being a GTA and a lecturer. My teaching efforts have always been geared towards creating a stimulating and challenging environment for learning, which enables the students to master the fundamentals and acquire the skills in problem-solving using both, ingenuity and insight, as well as fundamental principles. I try to be an approachable and supportive teacher. My main objective as a teacher is to help the students develop an ability to acquire, assimilate and exploit new knowledge and methodologies and to develop the powers of critical reasoning and observation. These are essential to the understanding and mastering of the scientific method.

I keep abreast of the latest developments in the teaching of subjects belonging to my broader scientific interests (condensed matter physics, mathematical physics, scientific computing) by attending seminars (e.g., *"Talking Teaching"* seminar series at Imperial College), sessions dedicated to teaching within larger scientific conferences (e.g., specialised teaching sessions within *American Physical Society* conferences) and doing peer observations.

My research work is at the interface of machine learning, mathematical physics, condensed matter physics and scientific computation. I believe that this research background makes me well-suited to contribute to teaching at Imperial-X in a number of ways. As part of my research activities, I developed a number of unique and versatile toolboxes and libraries for numerical solution of ODEs, PDEs, including Machine Learning applications, such as solving inverse problems. These can readily serve as a platform for teaching various courses across a number of disciplines and years, where teaching of mathematical methods will be accompanied by use of practical solutions in code, which I can readily offer:

• Latest numerical methods for solving local/non-local ODEs/PDEs (finite element methods, spectral methods, finite volume methods for conservation equations);

•Bifurcation analysis and numerical continuation methods for local/non-local ODEs and PDEs;

•Supervised machine learning methods using Gaussian processes for data analysis and statistical modeling;

•Bayesian inference methods for PDEs and inverse problems.

The tools which I routinely use in my research work, such as interactive notebooks and apps for data-analysis and basic note-keeping (e.g., **Jupyter Notebooks**, **Matlab apps**); symbolic algebra engines (e.g., **Maple**, **Wolfram Mathematica**, **SymPy**); programming languages (e.g., **Python**, **R**, **Julia**, **Matlab**, **C++**); computation, modelling and simulation software (e.g., **FEniCS**, **LAMMPS**); cloud computing solutions (e.g., **Azure cloud**) have great potential in teaching. Active use of these and similar tools can modernise and enhance

existing courses and serve as a platform for developing modern, state-of-the art curriculum in many mathematics-related subjects.

Undergraduate Teaching

Between 2015-19, I was actively involved with the teaching activities at the Department of Chemical Engineering at various levels (GTA, tutor and lecturer). I have taught courses from undergraduate level through to MSc, working in lecture theatres and seminar spaces. Additionally, I controlled the virtual learning environment (Panopto) and online forums for discussion/problem solving (Blackboard Learn). To my students, I provided both formal feedback on examination papers and informal feedback in lectures, one-to-one tutorials, email and online forums. I was involved in teaching the following courses:

• "**Mathematics-1**" (**CE1-07**) for 1st year Chemical Engineering undergraduates (approximately 130 students). I started getting involved in teaching this course in 2017, when I designed and gave 15 lectures on vector geometry, matrix algebra and linear systems. I received positive student feedback, and in 2018/19 took on more teaching responsibilities, designing and delivering 35 lectures on integral calculus, linear algebra, ODEs and linear stability.

During my involvement in this course, its SOLE scores dramatically improved. Every year I evolved the material, designed assessments, moderated and marked exams. Additionally, throughout the academic year, and beyond the term times, I continuously supported the course on Blackboard by answering questions about the course material and its relation to other courses (e.g., in 2017 I provided detailed and personalised answers to more than 50 student questions, across all course modules, often beyond the material taught on the course).

My experience in teaching CE1-07 gave me a good understanding of the needs and challenges faced by 1st year undergraduates. Typically, mathematical competence is extremely non-homogeneous across the 1st year cohort. This may be due to vastly different educational experiences of the UK and international students. Over three years of teaching CE1-07, I found that personalised support on the online forum helps alleviate this disparity.

• "**Dynamical Systems in Chemical Engineering**" (**CE4-09**) for 4th year Chemical Engineering undergraduates (this is an optional module with approximately 20 students). Here, I prepared and delivered 3 one-hour lectures on deterministic chaos and chaotic dynamical systems. I was also involved in moderating the final assessments.

Research Student Supervision

Between 2015-19, I took an active part in supervising research students at all levels at Imperial, from undergraduate (UROP: Undergraduate Research Opportunities Programme) and MSc to PhD:

• I was involved in the supervision of two PhD projects at the Department of Chemical Engineering, in the group of Prof. Serafim Kalliadasis. I used to regularly meet with the PhD students to discuss relevant literature, help them develop, test and debug computer code, and generally assist them in organising their research.

• In the same period, I co-supervised the following three MSc projects in the same group: *"Dynamical aspects of wetting by thin liquid films"*, *"Phase transitions and nucleation processes using density-functional theory"* and *"Nonequilibrium molecular dynamics simulations of nanoconfined fluids at solid-liquid interfaces"*. I helped formulate the projects and conducted bi-weekly meetings with the students, tracking their progress and supervising their research activities.