Application for a travel award

My name is Sultan, and I am a final year student at Yale-NUS College in Singapore. I am writing to request a SIAM Student Travel award, which will allow me to attend the SIAM NWCS20 conference, present my research, and help me advance mathematics.

Attending this conference comes at an important moment as I will be starting my PhD in mathematics. One reason for this is presenting my research as a poster, titled *"Approximate equations for the water wave problem in the shallow water limit on the whole and half lines"*. I have conducted this work under the supervision of Katie Oliveras during the past year. In the poster, a derivation of approximate equations for shallow water equations from a non-local formulation is presented, alongside the relevant numerical work. Describing my findings, getting feedback, and obtaining new ideas from conference participants will help me develop as a mathematician.

In addition, as I mature and become aware of many fields of mathematics as well as its applications, the conference will allow me to learn of general trends in the field of nonlinear waves and coherent structures. Indeed, nonlinear waves is one of my research interests, and this conference has featured many minisymposia on the numerous aspects of this topic over the past few iterations of the conference. In particular, I am interested in how the methods of spectral theory, scientific computing, and asymptotic analysis are used in studying and resolving problems of nonlinear waves. To this end, attending plenary talks by many field experts such as Bernard Deconinck, Sergey Nazarenko, and David Henry as well as minisymposia will allow me to attain this goal.

Finally, I am applying for the student travel award because at the time of the conference, I will have graduated from my undergraduate institution, but have yet to start graduate school. This leaves me in a position of being unable to apply for any funding at either my college or my graduate school. As such, the travel award will give me a chance to enjoy the conference during this inconvenient transition. Altogether, sharing my research and becoming better acquainted with the field of nonlinear waves and coherent structures will kickstart my journey as a mathematician and help me advance the field of mathematics.

Thank you very much for your consideration.

Sincerely,

Sultan Aitzhan

Poster abstract

Poster title: **Approximate equations for the water wave problem in the shallow water limit on the whole and half lines**

A free boundary, water wave problem is studied for an irrotational, inviscid, and incompressible fluids. Specifically, we describe derivations of approximate equations in the shallow water limit using a non-local formulation, introduced in [1] via a normal-to-tangential operator, in two related settings. One is the classical, whole line case, and another is a half line case, which physically is represented by putting up a tall and impenetrable barrier in the middle, so that all the fluid is flowing to one side. In both settings, non-local formulations yield expressions for the surface elevation, from which the appropriate wave and KdV equations are obtained. The numerical algorithm using the non-local formulation is developed, and the utility of a normal-to-tangential operator is examined via its numerical error, along with comparison to DNO and AFM formulations. Connections between the two settings are explored, and a number of interesting differences are noted.

References

[1] Katie Oliveras and Vishal Vasan, *A new equation describing travelling water waves*, J. Fluid Mech. (2013).