Joseph D. Peterson

Department of Applied Maths and Theoretical Physics

University of Cambridge, UK

(44) 0785 885 3664 jp838@cam.ac.uk

October 09, 2020
Faculty Search Committee
[DEPARTMENT NAME]
[SCHOOL ADDRESS]

Dear Committee Member,

I am applying to the tenure-track assistant faculty position at the department of [DEPARTMENT NAME] at [UNIVERSITY NAME].

I did my doctoral studies with Gary Leal and Glenn Fredrickson in the department of Chemical Engineering at the University of California, Santa Barbara. While there, I primarily worked on continuum models for shear induced demixing (SID) in well-entangled polymers. Three notable results from my PhD studies were (1) developing a new multi-fluid framework for studying the flow behavior of inhomogeneous polydisperse polymer melts (2) explaining the commonality (and distinctiveness) of SID in comparison to thermodynamically driven demixing instabilities and (3) accounting for finite size effects in predictions of shear induced demixing.

My postdoctoral studies have taken me to the University of Cambridge, UK, to work with Mike Cates on complex fluids and Ronojoy Adhikari on epidemic modelling. Working with Mike Cates, I have developed a new framework for incorporating population balances into linear and non-linear constitutive equations for breakable polymers. In collaboration with industry partners at Unilever, these models have proven to be a remarkable improvement – in speed, accuracy, and transferability – over the models they had previously been using. Working with Ronojoy Adhikari, I have developed flexible and efficient tools for modelling epidemics in which the disease dynamics are given as an explicit function of time since infection (TSI). TSI models allow a more medically accurate description of disease dynamics, but are typically computationally prohibitive to use. However, I developed a novel spectral discretization that dramatically reduces the computational burden of a TSI model.

Moving forward, I am excited to build a research group that addresses current and future problems facing the field of chemical engineering. Building on my current research interests, I am proposing a multidisciplinary research group focused on (1) soft matter physics and (2) biological systems engineering. In regards to soft matter physics, I am interested in modeling industrially relevant fluids under industrially relevant flow conditions. Improvements in the way that such materials are processed can have enormous market impacts by reducing waste, increasing through-put, and/or enhancing the value of the final product. In regards to biological systems, I am interested in modelling ecosystems (both natural and agricultural) under stress from invasive species, diseases, and climate change. It is my view that the future of chemical engineering must eventually include biological systems engineering at this level – agricultural ecosystems will play an important role in the renewables revolution, and natural ecosystems offer irreplaceable services such as water purification and carbon capture that are central to the future of mankind.

I feel very fortunate to consider myself a qualified applicant to the position at hand, and if given the opportunity I believe that I will be a valuable asset to the department. My research is ambitious and creative in its scope, but also cautious and thorough in its execution. I have real experience teaching undergraduate courses in Chemical Engineering, having been awarded a department fellowship to co-teach a numerical methods class with Mike Gordon in 2016. I also bring a unique perspective on the needs and interests of industry, informed by my time an employee at 3M and as a collaborator in my Unilever-funded postdoc. If given the opportunity, the [DEPARTMENT NAME] at [UNIVERSITY NAME] would be an ideal setting to put my skills and experience to work - the department has highly regarded faculty in all core areas of chemical engineering and a reputation for attracting motivated and capable PhD students. I am very grateful for the opportunity to apply, and I thank the committee members for their time and attention.

Sincerely,

Joseph D. Peterson