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Dear Dr Sousani,

I am writing to you because I am interested in doing an internship with EDEM. I am a third year PhD student at the Maxwell Institute Graduate School for Analysis and its Applications, a joint programme by the Universities of Edinburgh and Heriot-Watt. I am based at the School of Mathematics at the University of Edinburgh and my PhD project is supervised by Dr Ben Goddard and Dr John Pearson.

My research topic is PDE-constrained optimization for multiscale particle dynamics, which allows me to work on a broad range of theoretical and numerical tasks.
The theoretical aspect of my work focusses on the derivation of the relevant particle dynamics models and the optimality conditions for the corresponding optimization problems. The multiscale particle dynamics models considered in my work are continuum models, which can be thought of as reduced order models. The main advantage of these models is that they describe the particle dynamics on a macroscopic level, while also retaining some of the microscopic information of the system. They are nonlinear partial differential equations, which include an integral term to describe particle interactions.
Another facet of my work is the simulation of these models and the numerical solution of the corresponding optimization problems, focussing on the implementation of efficient algorithms. These algorithms rely on pseudospectral methods and are implemented in Matlab. An important aspect of my project is the application of the optimization method to industrial problems, such as brewing and nano-filtration and we are working with two industrial partners.

After my PhD I am planning to work in industry. In particular, I would like to work in an industry in which I could apply and expand my research expertise, such as in particle modelling and simulation. It would therefore be an excellent opportunity for me to work with EDEM, the market-leading company for DEM simulations. This would allow me to gain industry experience and to collaborate with engineers and developers. Furthermore, studying particle models on the discrete level would complement my expertise in modelling continuum dynamics very well. While I am currently intensively using Matlab and have some knowledge of Python, working with the state-of-the art DEM software would also give me the opportunity to expand my programming skills further. I am very interested in doing an internship with EDEM, since it would perfectly complement my research interests and expertise.

I look forward to hearing from you.

Yours Sincerely,
Jonna Roden