When Things Won't Let Go: A Sticky Problem in Industrial Drying

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Hi, my name is Dr Tom Hudson. Hi, I'm Dr Thomasina Ball and we're going to tell you a bit about the project When Things Won't Let Go, a sticky problem in industrial drying. So this is obviously a project that's part of the HetSys CDT and it's co-funded by our project partner Syngenta.

The project concerns a problem in industrial drying. Syngenta produce chemicals through synthesis and then they have to generally dry those products into powders for transport around the world. And to do that they use industrial dryers which are very large mechanical and thermal devices to basically drive the moisture out of the product and break up the product into powders.

However, under certain operating conditions (as you can see here) the product can become stuck to the walls and that's difficult for them to deal with. They need to break up the stuff that's stuck to the walls and it's very costly, expensive and causes lots of waste. So working with Syngenta in this project, we're going to build a mathematical model to describe the material properties of these dryers and find out what actually causes the stuff to stick to the walls.

So what are the benefits of having an industry partner such as Syngenta? Well firstly, the project will have a real world application, the idea is that you want to try and understand this problem and try and improve the system for them. The second thing is that they will be able to provide us with experimental data that will allow us to guide the kind of model development so we know whether we're going down the wrong direction or not. You'll also, alongside us as kind of supervisors, you'll have additional advice from colleagues at Syngenta who will be able to give you advice on the problem and intuition about when things work well and when things don't work well.

Finally, as part of working with Syngenta, you'll have an opportunity to visit their R&D facility to understand the kind of small scale experiments that they do to try and look at when this sticking process occurs. So what kind of things might you be doing as part of this project? Well, the central aim of this project is to build a reduced order mathematical model which incorporates lots of the dominant physics in this problem. There's obviously things like phase change, there's mechanical effects, there's lots of things that we need to take into account in this problem and so that's going to be a challenge in itself.

Then once we have a good model or we have a reduced model of some type, we're going to build an open source code to explore the drying process in a range of different scenarios and that will hopefully give us lots of insight into the process and what might be going wrong when it does. And finally, the thing that you'll be doing, obviously, is liaising with Syngenta and our project partners there to actually present the outcomes of the research in a way that hopefully is meaningful to them and informs their processes.

So what are we looking for in a candidate? So particularly we're thinking about someone who has a strong mathematical background, so someone who's done an applied mathematics degree or a physics degree and this is mainly because a lot of the work will be dealing with partial differential equations so it's important that you're comfortable with them and really keen to kind of learn analytical and numerical techniques to try and tackle them going forward.