Vestas Aircoil: Key insights from successfully bridging the gap between academia and industry

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Open Access Government engages in a conversation with Kevin Jose, a recently graduated PhD student who concluded his research and successfully defended his thesis at the University of Southampton. In this interview, Kevin shares his insights on transitioning from academia to industry

As part of the InDEStruct project, which received funding from the European Union's Horizon 2020 research and innovation programme through the Marie Skłodowska-Curie grant, Kevin Jose became the first among his four engineering colleagues to complete his work at Vestas aircoil and defend his PhD thesis.

Vestas aircoil is currently expanding its research and development facilities and activities in Denmark, actively engaging interns and PhD students to bridge the gap between academia and industry. In this article, Kevin Jose and his colleagues at Vestas aircoil candidly discuss their experiences, insights, and the outcomes of Kevin's research in academia and industry.

What was your role on the InDEStruct project?

In the InDEStruct project, I was one of the four early-stage researchers (ESRs) at the University of Southampton. Each of us, being PhD students, approached a common problem from different perspectives. For instance, one of our colleagues focused on materials research for the next generation of heat exchangers, particularly in additive manufacturing with metals such as steel. Another colleague explored the heat exchange and fluid flow aspects. As for myself and another colleague, we worked on vibration problems related to the project. I specifically contributed from an analytical and computational modelling angle.

You recently defended your PhD thesis. Could you tell us about its topic?

My PhD thesis revolves around the problems we encountered during the industry project. It consists of four substantive chapters, two of which were directly inspired by the challenges we faced regarding the dynamic behaviour of heat exchangers.

One chapter even involved the development of a graphical user interface tool that we transferred to Vestas aircoil as part of a technology transfer initiative. We packaged our analytical model and provided it as a computer code.

The other two chapters focused more on theoretical problems, which were, nonetheless, inspired by manufacturing tolerances and uncertainties inherent in industrial processes. Hence, half of the dissertation addresses specific problems that arose during the project, while the other half draws inspiration from industry-related issues.

How does your research relate to your previous work with Vestas aircoil?

The primary focus of my research, which is of immediate interest to Vestas aircoil, is gaining a better understanding of the dynamic behaviour of heat exchangers, particularly the critical component known as the tube-and-fin array or bank. My contribution involved computational and analytical modelling aimed at estimating the vibrational characteristics of these structures. While computationally expensive finite element simulations typically took anywhere from 20 minutes to a few hours, I leveraged the underlying physics to develop analytical or semi- analytical descriptions that reduced the computational costs to less than a second. Although this approach sacrifices some resolution and accuracy, it proved valuable in the early design phase where numerous parameter and material choices were being evaluated. Additionally, this reduced dimensionality technique helps to cope with the vast parameter search space, which renders comprehensive finite element-based investigations infeasible.

What is your perspective on bridging the gap between academia and industry?

I believe there are significant benefits for both academia and industry in bridging the gap between them. For academia, collaborating with industry provides access to real-world problems that hold immediate significance. On the other hand, industrial partners benefit from the fresh perspectives and unique tools and techniques brought in by academics, who offer a different vantage point from their day-to-day operations.

We started with a simplified model, gradually adding details as necessary. Applying the Pareto principle, also known as the 80/20 rule, we found that valuable insights could be obtained by focusing on the essential aspects while disregarding excessive details. Additionally, considering the diminishing returns curve, we recognized that adding more complexity might not necessarily yield proportional gains in understanding or practical benefits.

Claus Ibsen, Group R&D Director for Vestas aircoil, shared his perspective on the project: “As Kevin mentioned, this project brought a new and essential dimension to our company’s research endeavours. One valuable lesson we learned from the project is that we have to be able to scope the tasks correctly. When industry challenges can be effectively communicated through a toy problem, it facilitates efficient collaboration. The concept of a useful toy problem is instrumental in bridging the gap between academia and industry, describing what is needed to foster closer collaboration between the two.”

Do you have any plans for future collaborations with Vestas aircoil? What are your aspirations moving forward?

I have reached out to Claus Ibsen, and we are in the process of arranging a collaboration. There is an existing collaboration between my academic advisor and Claus Ibsen, which sets a foundation for our future collaboration.

Recently, we also discussed my transition towards material science and the application of machine learning in that field. I expressed my interest in finding potential areas of collaboration between my work and Vestas aircoil. It would be great to explore new opportunities together.

Is your current position a result of your previous industrial work?

There are multiple factors that contribute to my current position. Firstly, I am motivated by the intriguing research questions that arise at the intersection of academia and industry, particularly in the fields of engineering and physics.

Secondly, there is an understanding that machine learning and AI are becoming increasingly important and are likely to remain relevant for the foreseeable future. It is advantageous to acquire training in these emerging tools, as they are valuable skill sets and can enhance funding applications. These considerations align with the interdisciplinary approach often required in industry.

Although my previous industrial work did not involve machine learning in material science, it now forms a significant focus of my research. I can leverage my academic training as a mechanical engineer, which encompasses a strong foundation in material science.

In the application for the InDEStruct project in 2017 Vestas aircoil and project partner University of Southampton emphasized “the collaborative research program’s goal of developing technology leaders who can apply scientific methods from academia to interdisciplinary industrial design.

The proposed doctoral training program offers broad science-based training applicable to a wide range of engineering products and systems whilst using the development of advanced heat transfer technologies enabling more efficient and lower emission engine systems as a focus for training in interdisciplinary design.

A training program built upon the central theme of Engineering Design, providing a coherent structure for integration/application of distinct engineering approaches, highlighting the interdisciplinary nature of industrial research and development”.

In conclusion, Claus Ibsen remarked that “Kevin’s current position at the University of Cambridge, which focuses on a different topic than his PhD, has demonstrated our successful collaboration and exactly what we were looking for with this research programme”.

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