Khalil Al Handawi, PhD

⌂ Montréal Québec, Canada
☎ +1 (514) 572-7367
✉ khalil.alhandawi@mail.mcgill.ca
🌐 khbalhandawi.github.io
in linkedin.com/in/khbalhandawi

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Google Nest Team
San Diego, CA, United States Of America
Re: Multiphysics Analyst, Design Engineer

Dear hiring manager,

Dear talent acquisition officer, I am postdoctoral fellow at the Université de Montréal, department of computer science and operations research (DIRO), https://diro.umontreal.ca/accueil/ and I am very excited about this particular role and opportunity at Google because of my deep knowledge and understanding of simulation-based engineering design on which my doctorate is based on. I have considerable research experience in this field and particularly, the area of design space exploration. Based on the job description, I can tell that the Google NEST team is looking for someone that is able reconcile physics-based simulation with efficient and robust design.

My doctoral and postdoctoral experiences at McGill University and Chalmers University of technology (Sweden), happen to focus on overcoming the various challenges associated with this area. Although my doctorate focused on aerospace applications (with GKN aerospace in Trollhättan, Sweden as an industry partner) and not smart home technology, I feel that the simulation principles used in both smart home and aerospace products are similar and may overlap sometimes. My particular experience focused on manufacturing aerospace components using additive manufacturing (Directed Energy Deposition) for which I developed thermo-mechanical simulation models (using NX CAD for geometry and pathing, and Abaqus for finite element simulation) to asses the impact of geometry, process parameters, and design on the performance of the aeroengine part being made and check for warping and residual stresses due to the thermal loads. I believe that additive manufacturing technologies can be used in smart home appliances because of the flexibility of the designs that they offer. This is an area where I can come in and contribute.

After setting up all the simulation-based models, I automated the workflow using Application Programming Interface (APIs) scripting (NXOpen and Abaqus Python API) to generate and analyze various parametric designs. We used this to help out our industry partner at GKN aerospace explore thousands of design alternatives and narrow down the design space to a few promising designs. One major challenge that I encountered was the computational cost of running all these simulations. I proposed the use of surrogate modeling and surrogate-assisted optimization to reduce the computational cost and explore the design space iteratively using optimization rather than by sampling (e.g., random sampling and full factorial grids). This work has been published in the Journal of Mechanical Design (JMD), where it was selected for an editor's choice award and will receive recognition from the American Society of Mechanical Engineers (ASME) community during a conference in St. Louis, Missouri.

I have recently started a position in the Computer Science and Operations Research Department at the Université de Montréal. This opportunity is helping me understand the mathematical foundation of the optimization and statistical modeling tools that I used during my doctorate because I believe that engineering design will rely on a combination of statistical modeling and simulation-based models for design space exploration.

Finally, I have worked on small scale software development projects at various research labs, particularly the systems engineering design lab at Chalmers University, Sweden to develop open-source python packages for translating design theory into practice and software. This experience has taught me how to work in a team albeit not a large one as would be the case in industry. Nonetheless, I have learned a lot of sound coding practices and package development standards that ensure collaboration and development are possible by others.

I believe that my strong mathematical and simulation skills, experience in software development, and understanding of the industry's simulation needs will add a lot of value to the development efforts of the Google Nest Team. I hope you enjoy going through my profile and my projects on my website (https://khbalhandawi.github.io/proje and I hope we can discuss all of this. I feel that being a part of a giant technology firm that provides hundreds of revolutionary products such as Google will allow me to reach my career goals and make an impact in the lives of millions of people, whether it is for those that have a place to call home or those that don't. This is what drives my research and in particular my focus on product design.

Yours sincerely,

Khalil Al Handawi