

Timeless Design *for the* **DIGITAL AGE**

With a luxury design aesthetic and a reputation for the highest product quality, Sub-Zero is also focused on groundbreaking innovation. Today, that means the addition of smart product functionality and connectivity. Anderson Bortoletto, the company's principal engineer, recently spoke with Dimensions about how the Sub-Zero product development team is taking this 70-year-old business into the digital age, while retaining its products' traditional appeal.

DIMENSIONS: Sub-Zero has been a premier refrigeration brand for over 70 years. Why do you think your brand has been so successful with consumers?

ANDERSON BORTOLETTO: Sub-Zero was founded in a spirit of innovation, and we've always had the goal of taking refrigeration performance to a new level. Sub-Zero Freezer Company was created in 1945 by Westye Bakke, a Wisconsin entrepreneur who was looking for a more reliable way to store his son's insulin. Refrigerators of that time period did not regulate or control temperatures very well, so Sub-Zero represented a revolutionary idea. By launching the concept of dual refrigeration — in which different zones are kept at extremely precise temperatures — our company changed the industry.

Since then, Sub-Zero has continued to lead with high levels of product performance, including exceptionally accurate temperature control and outstanding food freshness. Our company is also known for its timeless, uncompromising design aesthetic. When we have made innovative changes to meet market needs — for example, adding high-performance air filtration systems inspired by NASA — our engineering team has ensured that the prestige look and feel of our appliances remains unchanged. We need to combine cutting-edge performance with a timeless appearance.





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DIMENSIONS: One of the biggest product development trends, across all industries, is the addition of “smart” digital features. Is Sub-Zero embracing that trend?

AB: In keeping with our commitment to innovation, Sub-Zero is certainly exploring how we can leverage the Internet of Things (IoT), connectivity and other new technology concepts to deliver on our core mission of understanding and meeting consumer needs.

I do not want to discuss any of our specific product development efforts since they are confidential. But I can say that any future smart functionality will be aimed at meeting demonstrated user needs, as opposed to being “gimmicky.” Any design improvements will be targeted at making consumers’ lives easier or better, without changing our foundational principles. For instance, we are never going to mount a television screen on our refrigerator doors. We are never going to compromise the privacy of our customers by sharing their grocery needs with third parties. Similarly, we are not going to change our overall design aesthetic and our traditional appeal to luxury consumers. Even as our products get smarter and offer more features, they will still retain the aesthetic appearance and luxury feel that are so valued by our consumers.

DIMENSIONS: How is your engineering team making trade-offs between new functionality and traditional design aesthetics?

AB: Since 2011, we’ve relied on engineering simulation to make these kinds of trade-offs quickly, without sacrificing product reliability or quality. Today more than ever, our product development team needs to work fast and efficiently to drive innovation and maintain our industry leadership. Simulation helps us accomplish that.

We began in 2011 with two users of simulation software, who were studying fluid flows inside the refrigerator. Today we have more than 15 users across the engineering department, and we rely on high-performance computing (HPC) and cloud technology to support our aggressive simulation efforts.

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We are applying multiple physics and studying our designs at the system level, because that really enables us to see the impact of any change on the whole product system. For instance, if we are considering the addition of a new interior feature like an icemaker, we can immediately see the impact on the appliance's exterior. We can understand important design implications rapidly, at a very early stage, through digital exploration. In fact, we have reduced our early feasibility studies from months to weeks. We have been able to reduce our physical prototypes by 25 percent, which allows us to work much, much faster and more cost-effectively.

DIMENSIONS: Increasing the number of simulation users is a challenge faced by many companies today. Have you identified any best practices or lessons learned from this experience?

AB: Certainly one key at Sub-Zero has been establishing a group of enthusiastic "champions" who communicate the value of simulation and mentor new users. Not everyone needs to be a simulation expert; it is valuable to have engineers with limited simulation skills who can work on small, well-defined projects with clear deliverables. But you really do need those expert users who can lead the effort and demonstrate the tangible benefits of engineering simulation for long-term, highly innovative design efforts. They can coach others and ensure that simulation is consistently being applied in the highest-impact way, for even the smallest design projects.

We have also found it critical to partner with ANSYS for ongoing training and support. There are so many capabilities of simulation software, and we want to remain at the leading edge of engineering by leveraging all of those

2018 AND FUTURE

- System-level simulation
- Optimization

2017

- Number of HPC packs doubled
- Cluster created
- Cloud computing
- Synergy among users
- Dedicated IT support for simulation infrastructure

2015

- License and Hardware Expansion**
- Doubled ANSYS Mechanical and ANSYS Fluent licenses
 - Added physics
 - Quadrupled number of users
 - HPC packs added plus Workgroup HPC

2012

- License Expansion**
- ANSYS Mechanical license added
 - More HPC
 - Number of users doubled

2011

- ANSYS Introduced**
- ANSYS Fluent
 - ANSYS Polyflow

capabilities. As ANSYS adds new features, our goal is to master and apply those features rapidly, to continually optimize our product development work at Sub-Zero.

Finally, Sub-Zero could not have grown its simulation expertise and capabilities so quickly and successfully without the support of our top management team. Our executives recognized early on that simulation represents a strategic and competitive advantage for our business — and they continue to provide the resources we need, including dedicated technology investments, to increase the impact of simulation not only in product development, but across the business.

DIMENSIONS: What you're describing — expanding the reach of simulation beyond the engineering function — is often called "pervasive simulation." Is that a focus at Sub-Zero today?



AB: Though pervasive simulation is a new term, I think it's an old idea at Sub-Zero. Since 2011, simulation has actually caused a cultural change at Sub-Zero. Our product developers routinely show their simulations to executives, to the operations team, to distributors — and our entire business now has a shared language to talk about product performance and quality. We have meaningful technical discussions every day, across multiple functions, and they are not abstract. They are grounded in the real world. We also routinely show new features to customers via simulation. Everyone can look at the exterior of our products and see their beautiful appearance, but now they can see the hard-working technology inside via engineering simulation.

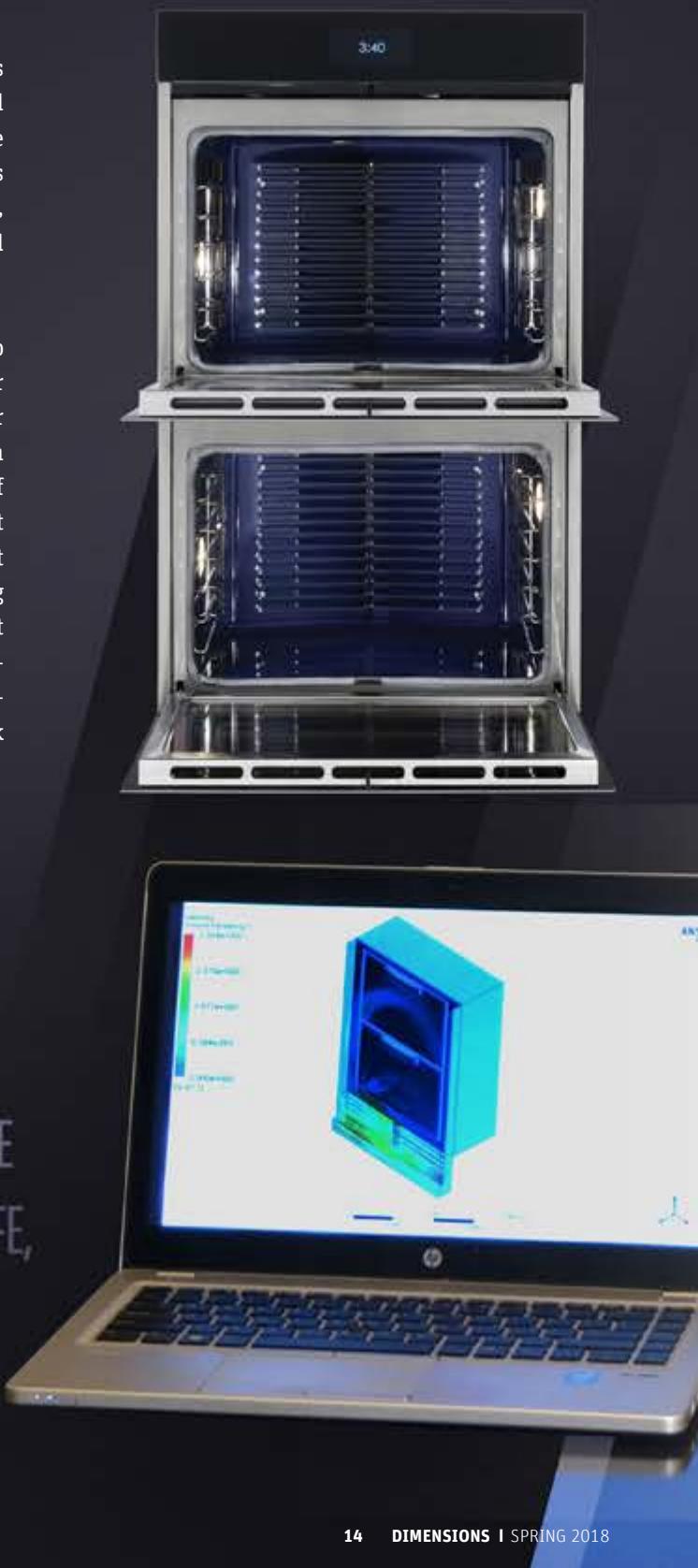
Simulation has also helped Sub-Zero pursue a manufacturing strategy of mass customization. Our products begin with the same basic exterior design, but then we offer consumers many choices. For example, our Wolf line of ranges — which we acquired in 2000 — can be ordered with gas, induction or dual-fuel heating technology. Via simulation, we can design our products for fast, cost-effective customization in the production facility.

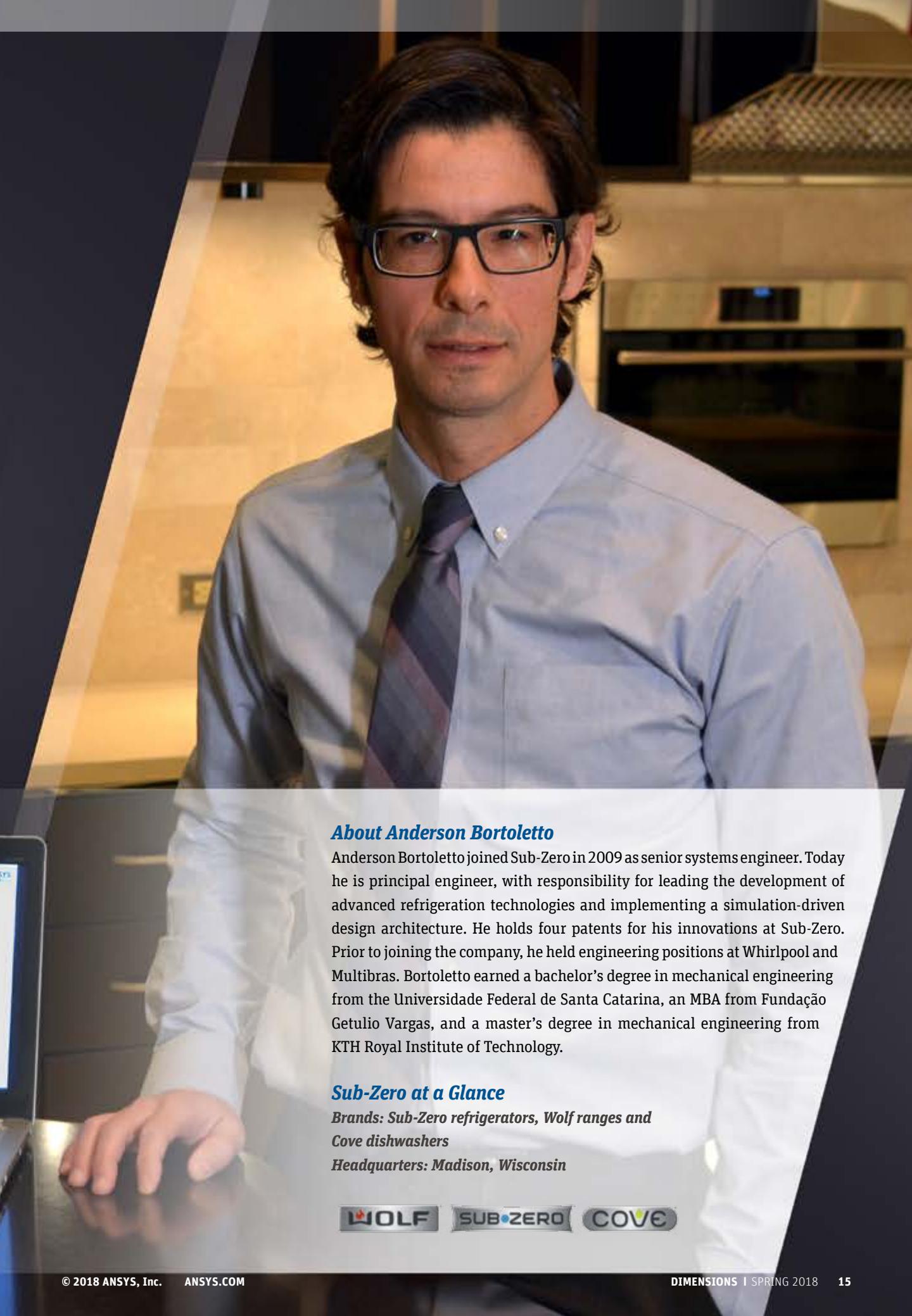
In the future, we strongly believe that simulation is going to help Sub-Zero capitalize on 3D printing and other emerging technologies that are set to change the face of manufacturing. If we can design our appliances specifically for tomorrow's manufacturing environment, we can remain at the forefront of production quality and efficiency.

Looking ahead, we also think simulation might help us collect and apply field data, which will increase our products' performance and reliability to an even greater extent. While the IoT may help us gather information from actual households, we always need to be mindful of our consumers' privacy and data security. If we do collect data, only Sub-Zero would be able to see and access that information. As a possible alternative, we are exploring the concept of creating digital twins of our products that replicate real-world conditions in a safe, virtual environment. By feeding that data back into product development, we can better understand how our products work over time in the field.

There are so many exciting possibilities for expanding our use of simulation in the future, and Sub-Zero is interested in all of them. Just as our products have relied on technology innovation since 1945, our team must utilize the most advanced engineering technologies available in 2018 and beyond to maintain our leadership. 

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About Anderson Bortoletto

Anderson Bortoletto joined Sub-Zero in 2009 as senior systems engineer. Today he is principal engineer, with responsibility for leading the development of advanced refrigeration technologies and implementing a simulation-driven design architecture. He holds four patents for his innovations at Sub-Zero. Prior to joining the company, he held engineering positions at Whirlpool and Multibras. Bortoletto earned a bachelor's degree in mechanical engineering from the Universidade Federal de Santa Catarina, an MBA from Fundação Getulio Vargas, and a master's degree in mechanical engineering from KTH Royal Institute of Technology.

Sub-Zero at a Glance

Brands: Sub-Zero refrigerators, Wolf ranges and
Cove dishwashers

Headquarters: Madison, Wisconsin

