

## Teaching the next generation of business leaders to optimize world-leading supply chains



### Featured professor

Willem-Jan van Hove  
Associate Professor of Operations Research at Carnegie Mellon Tepper School of Business.



### Tell us a little bit about your experience

I'm originally from the Netherlands and I did my master's in applied mathematics at the University of Twente. During that program, I took a course in Operations Research and started applying mathematical programming models to solve real-life applications. I became very intrigued by the field. Mathematical programming technology can have big impact in practice. So, I decided to specialize in this field.



### How long have you been using AIMMS?

I've been familiar with AIMMS for a long time. I first encountered AIMMS during my master's. Johannes Bishop, founder of AIMMS, was my professor and thesis advisor then. When I was looking for topics for my dissertation, he suggested that I look at the integration of constraint programming with mathematical programming. This was during the late 1990s. It was a new research area at the time. People saw opportunities to combine these techniques. AIMMS was primarily a mathematical programming language back then. My task was to research how the latest advances in constraint programming could be applied in AIMMS software, and what would it mean from a design perspective.

This was mainly a strategic endeavor and a few years ahead of its time. The market for constraint programming was growing, but it was not mature enough. A few years later, in 2005 to be exact, I went back to work with AIMMS to help implement the actual constraint programming interface into the software. The maturity of solvers like IBM ILOG CP Optimizer was at a high enough level to make this work successfully.

Now, I'm sharing the experience I built throughout the years at the Tepper School of Business' MBA program.



### Can you tell us more about the MBA program?

The [program](#) offers different concentrations and tracks. We use AIMMS to teach in the [Operations Research](#) and [Business Analytics](#) track.



### Why did you decide to use AIMMS for teaching?

We have an “Introduction to Optimization” course, using Excel and spreadsheet models. This works well for the majority of students, but we have a fairly quantitative program and many students are also interested in using state-of-the-art technology and solvers, like the ones AIMMS offers. So, I developed a new course called “Operations Research Implementations” in collaboration with my colleague Michael Trick. We use AIMMS as the main tool to do the implementation of the model, use solvers in the background and visualize the results.

Without AIMMS, I would not have done this. We only have six to seven weeks to teach the students more abstract modeling features like reasoning over index sets, constraint generation, column generation, and more. We solve very large-scale models for actual projects. If I had to teach students, for example, more program-like environments like Python and had to do more lower-level interfacing with the models and solvers, I wouldn’t be able to fit that in six to seven weeks. But if I give them an AIMMS license and a one-hour tutorial, they’ll be up and running quickly. They already have an understanding of variables, objectives, constraints and so forth. Making them develop a model in AIMMS is straightforward. After a week, they are perfectly able to recode all the models they worked on during the introductory course, in AIMMS. That speed in model development was essential. AIMMS also offers many features that allow us to do scripting, column generation, and visualization. The latter is super important, especially for the projects we have.



### What kind of projects do you and your students work on using AIMMS?

We’ve worked on several kinds of projects, in industries ranging from healthcare to finance and energy. We typically work with 3-5 sponsors (companies that provide use cases for our students).

For instance, we worked with a U.S. bank to do branch network optimization. We also worked with [BP](#) to solve a challenging barge scheduling problem. The barges transport materials between chemical plants, and our model delivers optimal routes that simultaneously handle the inventory constraints at each plant. For this, we used a very effective constraint programming formulation.

More recently, we developed two AIMMS-based optimization models at a large steel manufacturer. The first was a batching model and it used a constraint programming approach. The second model, which we worked on as a follow-up, tackled a complex melt and roll scheduling problem.

Some others come to mind. For example, we developed a network design and routing app for a company that replenishes gas stations in the north east of the U.S. and parts of Canada. This was a traditional vehicle routing problem. The interesting part was that some gas stations were under contract (or subsidiaries), while others were only replenished ad hoc. It was challenging to construct the

replenishment routes. We developed a prototype in AIMMS and could show that our app would contribute 15-20% in savings, mainly due to more efficient routes and less fuel usage.



### **What's the most rewarding project you and your students have worked on?**

Some projects are great because students can implement everything they learned to make a meaningful impact in practice. That was the case with [Angel Flight West](#). We developed a model to optimize flight routes for this non-profit. They provide non-emergency air travel for children and adults with serious medical conditions and other compelling needs, operating over 4,500 flights per year with a network of volunteer pilots. This was a rewarding project because the AFW team deployed the solution in practice, and our students were willing to continue to develop the model in the AIMMS Cloud and WebUI – even after the course was over.



### **Do your students often use AIMMS post-graduation?**

Yes, many have gone on to work for consulting companies like AT Kearney or large energy companies, where they apply AIMMS. Most recently, one of our MBA students went from an AIMMS Learning Lab competition to working for a large airline and later, for a large provider of optimization solutions developed for the food industry.

## **You can use AIMMS in the classroom too!**

AIMMS is leveraged by thousands of students, at some of the most prestigious universities in the world, to find innovative solutions to global problems. Our ties with academia have helped us further our mission to bring the benefits of prescriptive analytics to society, and we are proud of our academic heritage. We provide support, free licenses and training materials to help students and researchers master our technology. AIMMS comes with solvers for linear programming, mixed integer programming, nonlinear programming and mixed integer nonlinear programming. If you are a student, faculty, or staff member at a recognized degree-granting institution, you may be eligible for a full-featured AIMMS academic license at no charge. Learn more about the [Free AIMMS Academic license](#) and request your own!