

...transforming design in the pursuit of products and components currently beyond our imagination...

I'm Jan Vandenbrande, and I am a DSO program manager for math, modeling and design.

I have always been fascinated by how to design and build things better and faster. One of the great things I enjoyed in my electrical engineering studies is that you can write down a mathematical expression and in many cases map it directly into a circuit diagram or VLSI layout. However, when I looked at mechanical design, I discovered that you cannot describe the desired function or behavior as a mathematical expression and then map it into a shape. Instead, what you have to do is to guess what the desired shape should be, and then test whether your guess actually works. If it doesn't work, which is usually the case, you have to figure out what to change and then iterate until it works.

This makes mechanical design really hard, and unfortunately it just got a lot harder. Amazing new manufacturing methods have emerged, like weaving (to build 3D structures), composites, 3D printing, which allow you to create shapes that were previously impossible to make, and it also allows you to create material behaviors that do not exist in nature. Consequently, we now have many more design options available to us. The problem is, we don't know how to leverage all these new options because we are limited by our tools that are based on traditional manufacturing methods and by our own human understanding.

DARPA is an amazing place. It's one of the few places in the world where, as a program manager, you have the flexibility to plant the seeds of an idea to fundamentally change the world.

The reason why I'm here at DARPA is to transform design to allow us to discover new physical products and components that are currently beyond our imagination and beyond the capabilities of our tools. In this vision, humans will focus on what they are good at, which is non-linear thinking—getting ideas from different areas—and problem formulation, while the role of the computer will be to do what it is good at, which is generating alternative designs that combine shape and materials at the same time, and searching through this enormously complex design space to find the golden design nuggets. I am looking for disruptive ideas grounded in mathematics, computer science, data analytics and artificial intelligence to enable this vision. If you have ideas in this area please contact me, and let's talk.