Bringing sheet metal into the fold

A chance meeting with an expert in stainless steel gave industrial designer Tue Beijer of Swedish startup STILRIDE the inspiration to develop a new technique of folding to create complex three-dimensional shapes from flat sheets of stainless steel.

Tue has designed everything from industrial machines to household appliances for major brands but had the ambition to design an electric scooter that is sustainable, affordable and straightforward to make.

Speaking about his idea, he said: “I made my first scooter when I was 19 and have always dreamed of building on that experience. But most of all, I wanted it to be cheap and easy to build with simple tooling, and durable and long-lasting materials. That called for straightforward design with fewer components and less welding.

“Most scooters bodies are constructed with a combination of steel and molded plastic. I wanted to create the sort of complex shapes associated with classic scooter design but using the type of folding and cutting that you do in origami.

“I played with the concept and developed a full-sized model in cardboard. When I showed it to my associate Jonas Nyvang, he shared my excitement. We decided to form STILRIDE to take the idea forward, winning a grant from Sweden’s innovation funding agency Vinnova.”

The LIGHT.FOLD technique

Since then, Tue has further developed a new fabrication technique for digital manufacturing that is a form of industrial origami. He has called the technique LIGHT.FOLD to show how it combines collaborative robotics with bending of sheet metal.

It’s similar to the technique of scoring card to control where it will bend. Paper artists use this method to create complex 3-D shapes.

The LIGHT.FOLD technique uses computer-controlled lasers to deliver heat treatment with pinpoint accuracy, with robots precisely bending the sheets into the required shape. This final bending process partially regains the strength of the original flat sheet – an important factor in keeping a lightweight scooter design.

A similar concept is used by industrial engineers to build pressure vessels and chemical storage tanks, as well as in specialist applications like escape tunnels on oil platforms. These applications also start with temper-rolled sheet, as it has been pre-hardened by cold rolling at the steel mill. Engineers working in these fields also use localised heat treatment to enable bending and forming of large sheets.

Hitting the road in 2022

The focus for now is to prove the concept and launch the e-scooter. Next steps are to refine the design, carry out type testing and start accepting orders in late 2022, followed by ramping up production in 2023.

Tue says: “In a typical scooter, you’ll find hundreds of components and design details, as well as a wide variety of materials. All of these need time and attention during design and manufacture, as well as sourcing, procurement, test and qualification of components. And any of them could go wrong and need replacement during the scooter’s lifetime.

“We’re using fewer materials, components and production steps. That makes our scooter less costly to produce. And we’re confident that our scooter will be lighter and more rigid than its competitors thanks to LIGHT.FOLD. We’ll know exactly how much lighter once we have fine-tuned our bending technique and optimized the design to select the ideal sheet thickness to give us the strength we need.”

However, Tue believes that LIGHT.FOLD has potential for much wider adoption and is already thinking of potential future applications.

He also believes the LIGHT.FOLD technique could be used to simplify logistics. Instead of shipping complete products, companies could carry out heat treatment on blank sheets for folding and finishing in local machine shops around the world.

He also thinks that it could help to make engineering workshops more efficient, with potential to save 20 to 50 percent of material costs, as well as 25 to 45 percent manpower.