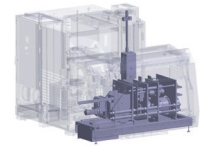


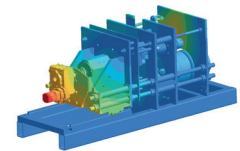
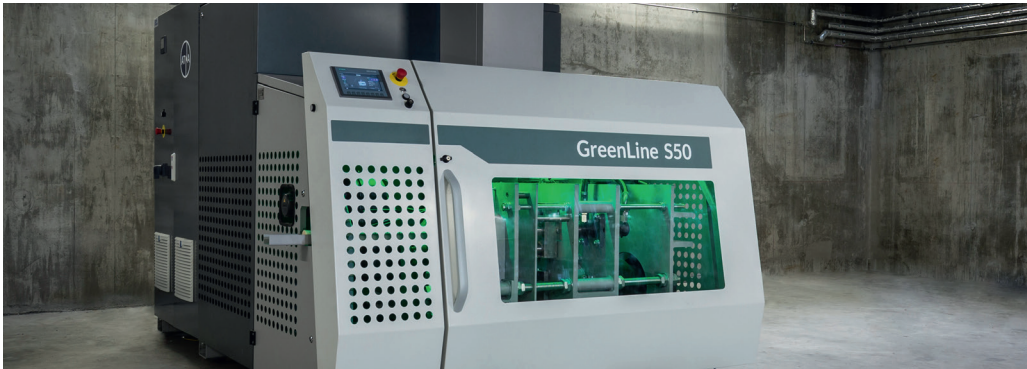
# SIMULATION UNDER HIGH PRESSURE – FAST RESULTS FOR COMPLEX MACHINES

By acting flexibly and driving innovation, mechanical engineering has taken up the challenges of recent times. In this context, often the startups enrich the sector with innovative ideas and leverage digitization for their revolutionary machine designs. ATNA Industrial Solutions GmbH has accelerated the design and development process of its novel hydraulic press with the help of a new simulation tool, thus achieving its ambitious development goals.

Innovation is the decisive factor in special machine construction when it comes to tailoring precise special solutions to the individual needs and requirements of customers. Besides traditional companies that can draw on decades of experience to develop their machine designs, it's often today's startups that know how to use digitization and simulation-driven development for their processes and apply these software solutions to their designs.



Altair Simsolid® enabled a holistic assessment of the briquette press



Simulation of all load-bearing elements

ATNA Industrial Solutions | Altair

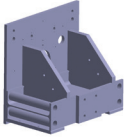
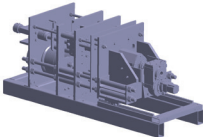
ATNA Industrial Solutions GmbH is one such startup that wanted to implement its idea of a new generation of machines and develop market-ready products. The company started off at the Technical University Bergakademie Freiberg with a research project funded by the nationwide program for startups. As part of this two-year research project, four engineers developed a new hydraulic briquette press and built their first prototype. Inspired by the success of this prototype – which realized high quality briquettes at high throughput – and their vision to revolutionize briquetting by building better, more efficient briquette presses, the engineers founded ATNA. Today, the company designs and manufactures customized hydraulic presses of all sizes for the global market.

## Efficiently Compressed

The concept of briquetting (the compression and pressing of various raw materials from iron powder to wood as well as residual materials such as metal chips or sewage sludge) has become enormously important. While the past relied mainly on fossil fuel and raw materials, customers' focus today is on renewable resources and sustainability in order to achieve European carbon emission targets. Since these targets can only be achieved by phasing out lignite, many large plants in Europe will stop producing lignite briquettes by the end of 2022. To meet the still-high energy demand with fewer emissions, one focus is on sustainable fuel processing, including biomass briquettes, which can be produced from various residual materials, as a regenerative energy source. And to make briquette production as efficient as possible, new, high-performance and flexible presses are needed that maximize energy efficiency, provide optimal material throughput, and support a top quality end product.

## Top Quality With High Throughput

Briquette presses are divided into two different machine types: conventional and hydraulic. While conventional briquetting presses like the roller press achieve high throughputs, they struggle producing high-quality briquettes of difficult raw material.

	CAD integrated FEA Solution	SimSolid normalized to initial CAD assembly	SimSolid
Simulation disciplines	Deformation, mechanical stresses, loads on individual components and smaller assemblies		Deformation, mechanical stresses, loads on all assemblies as well as the entire machine
Number of components to be considered in the simulation model	25	25	1500
Typical model size			
Initial CAD preparation & FEM modeling	8 hours	30 min	3 hours
Debugging – fixing modeling errors	Mistakes are identified only after a timely advancement of the calculation run.		Speedy simulation allows fast modeling correction. “You get to the result quickly and can build on it”.
Solver Run (Waiting time)	several hours	seconds	-5 min
Accuracy of the results	The necessary simplification of the model does not allow the loaded assemblies to be supported close to their relative positions and leads to considerable effort in interpreting the results.		Consideration of the complete machine, including the interaction of all load-bearing assemblies, provides realistic results.
Run a simulation for a design variant	several hours	- 5 min	- 30 min
Number of possible simulations per design revision (variant analysis)	max. 1, not willingly more	as many as required	as many as required

The consideration of the complete machine, including the interaction of all load-bearing assemblies, provides realistic results.

Especially in briquetting residual materials and biomasses, high wear must also be expected on the rolls. On the other hand, hydraulic presses deliver high quality, but at the expense of low throughput. This is exactly where the ATNA engineers step in. By developing a hydraulic press that is less prone to wear and requires less maintenance, they launched a new generation of briquette presses that produce very high throughputs, deliver high briquette quality, and are cost-effective.

Traditional ram presses usually operate in a single stage and thus have high energy consumption since the hydraulic ram has a long journey to compact the material. Therefore, the ATNA engineers designed a press that processes the material in a multi-stage process (pre-compacting, pre-pressing, main pressing, and pressing out) simultaneously, which vastly increases throughput. Thanks to a novel, double-sided pressing process, the new machine is more energy-efficient and can handle biomass throughputs of up to 1000kg per hour on one press, with fully automatic, 24/7 operation. To ensure all machine parts would withstand stress, the engineers used simulation.

### Fast Results for Large Constructions

To check the individual components and subassemblies, the team initially resorted to the available CAD-embedded FE tools. But this was too cumbersome and time-consuming. ATNA couldn't implement a complete analysis of the entire machine. Simulation was limited to the necessary calculations of individual components. To achieve their design goals, however, ATNA needed a bigger picture and a holistic assessment of the new designs, so they sought a new solution that could speed up their development process. ATNA engineers had the opportunity to try Altair SimSolid® structural analysis software as part of the Altair Startup Program, and were impressed right away. The SimSolid structural simulation tool helped the ATNA team quickly and efficiently simulate entire machines with a high level of accuracy and validate their designs.

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SimSolid also enabled the ATNA team to study entire, complex assemblies with more than 2,800 parts. Engineers defined the exact forces and resulting deformations and stresses of the entire system, gaining comprehensive structural insight into the machine's behavior. This helped the engineers assess the impact of design changes. Simulations using SimSolid were performed at the pace of design and identified adverse operating conditions, weak points, and design flaws early on. While the team used to need several days to calculate even the smallest model changes using traditional Finite-Element-Method (FEM) tools, SimSolid delivered initial results and reliable statements about the machine behavior in just 30 seconds.



Altair SimSolid® allowed for a holistic assessment of the briquette press ATNA Greenline S50

“SimSolid allows us to simulate our highly complex machines in a very short time, something that would not be possible at all with traditional methods,” said Hagen Möller, development engineer, ATNA. “The speed of Altair SimSolid helps us gain insight into the behavior of the entire machine operating under loads very quickly and very early in the design process. **Because of the ease of modeling and minimal computation time, SimSolid can be used throughout the design process for any design change, unlike conventional FEM tools. This increases confidence in design decisions. This is especially important for us as a young company with limited resources.**”

### Good Press Guaranteed With Altair SimSolid

ATNA developers used SimSolid to optimize and validate their innovative design. Meanwhile, ATNA also uses SimSolid to customize presses to meet specific customer requirements, such as special operating conditions including high forces up to 5600kN.

Thanks to SimSolid's minimal modeling time and high computational speed, the team can model and simulate large and complex machine structures and subassemblies within minutes. This allowed them to fully evaluate many variants in the given time frame to find the best design. Whereas previously the design team would have to wait several days for the results of the structural analysis for reviews of a small design change, they can now identify errors and accurately predict the impact of a design change within minutes or even seconds.

### Developing With Vision

Development at ATNA and everywhere in mechanical engineering never stands still, of course. From simulation-driven development to the first prototype and virtual commissioning thanks to system simulation, to the prediction and reduction of maintenance intervals, optimization is ongoing. And artificial intelligence (AI) and machine learning (ML) may play an important role in the future. And when it comes to looking at the raw materials, machine developers like ATNA are also well advised to get help from digitization. When processing raw materials such as waste wood and metal chips or solid residues from other waste products, users can quickly and easily predict and optimize machine behavior with the help of a simulation of bulk materials and the appropriate tool, such as Altair® EDEM™. As an Altair Startup Program customer and thanks in part to Altair Units, Altair's flexible licensing system, ATNA can access every Altair product, giving them the ability to address their biggest challenges with the right solutions.