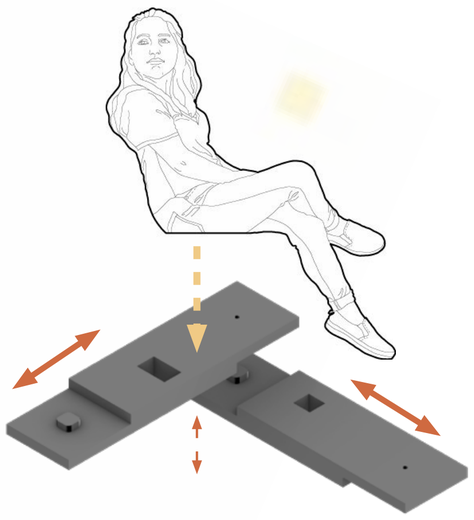
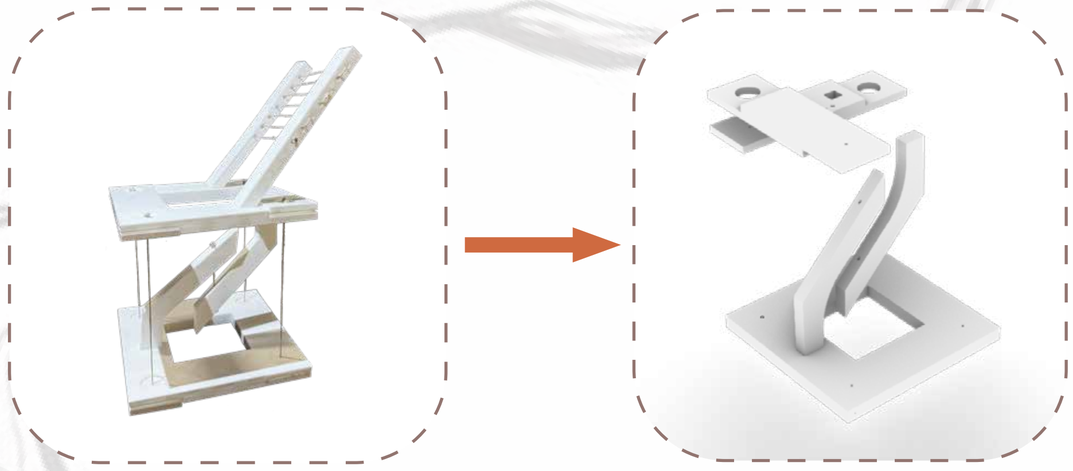
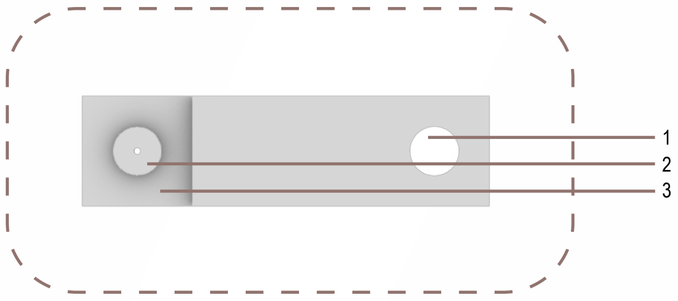
Final Review



By incorporating nodes into the joint, it effectively prevents movement along both the x and y axes, ensuring the chair remains securely fixed in place. Additionally, forces along the z-axis, which are generated when the user sits down, are absorbed and prevented, further enhancing the chair's stability. This design ensures that the chair remains stable and secure under typical usage conditions, providing both comfort and durability.

In the a3 section, we provide an outlook on the potential of this joint design. Owing to the inherent properties of the joint, it is capable of extending indefinitely along a single axis, which introduces significant flexibility in its application. This characteristic allows the joint to be utilized across a variety of contexts, offering versatility for numerous potential uses. The ability to extend the joint along one axis makes it highly adaptable, providing solutions for both simple structural frameworks and more complex, dynamic systems. Such scalability holds considerable promise for future projects, enabling the design to be applied in a broad range of industries where both stability and adaptability are required. This flexibility could prove instrumental in the development of more efficient and versatile systems in the future.





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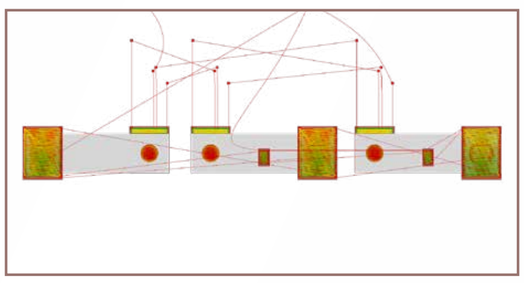
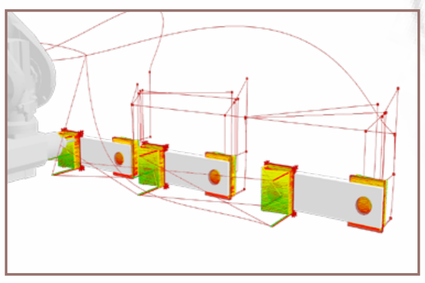
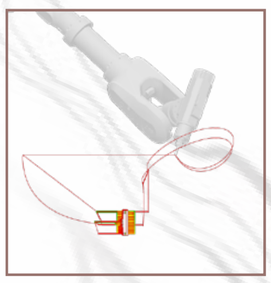
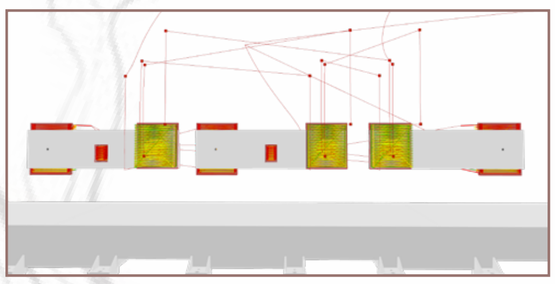
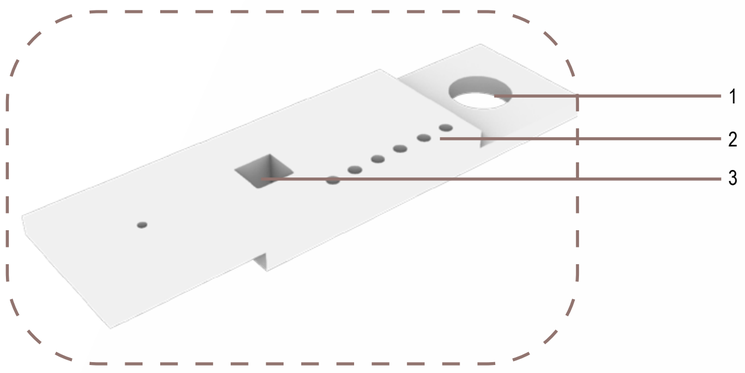
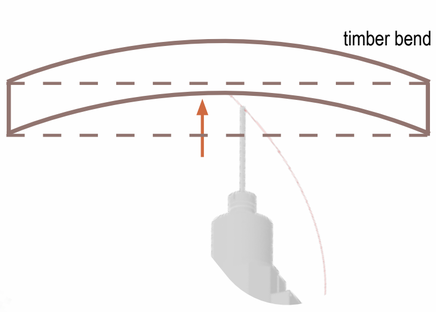
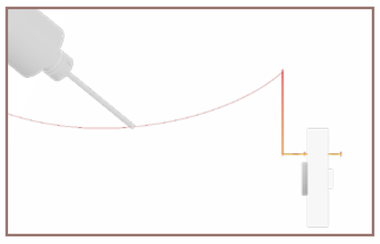
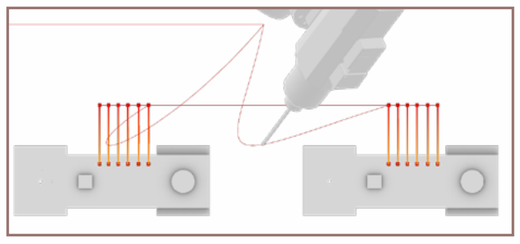





In our preliminary research, we discovered that machining paths for multiple identical double-sided components can be standardized and unified. This optimization significantly reduces initial calibration time, minimizes wood waste, and facilitates modular batch production.

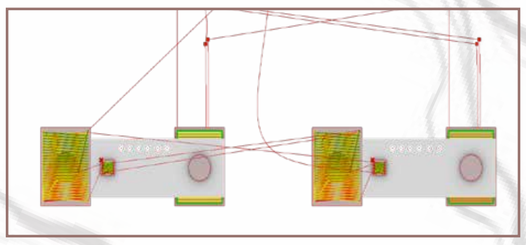



During the drilling process, localized force at a single point can lead to stress concentration, causing gradual elastic deformation of the wood. As the drilling depth approaches the wood's tolerance limit, rapid rebound may occur. This sudden deformation can exceed the wood's stress threshold, resulting in distortion, cracking, or fracturing. Additionally, the rebound effect may cause tearing on the opposite side of the drilled hole, further compromising the structural integrity of the wood.

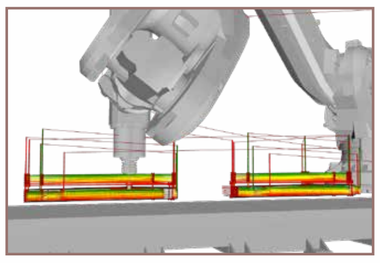
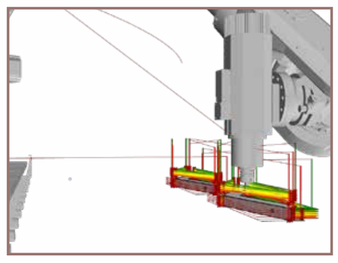
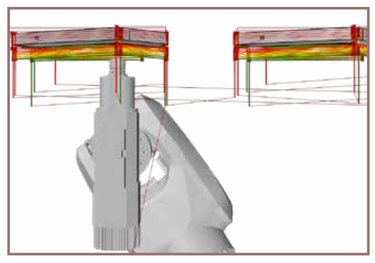


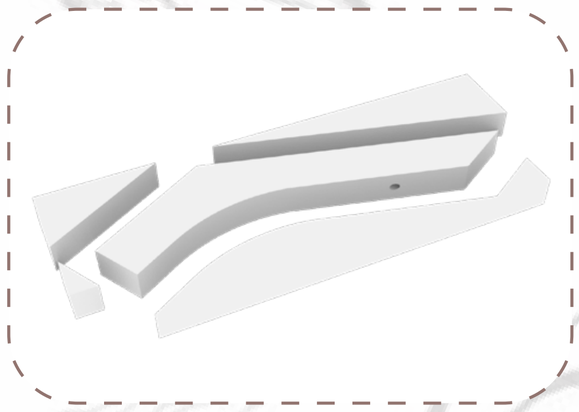
The milling path strategy involves first machining the wood panel to achieve the desired shape and finish, followed by executing the drilling path. This sequence ensures proper preparation of the panel, minimizing tool interference and improving accuracy, while optimizing both processes for efficiency and precision.

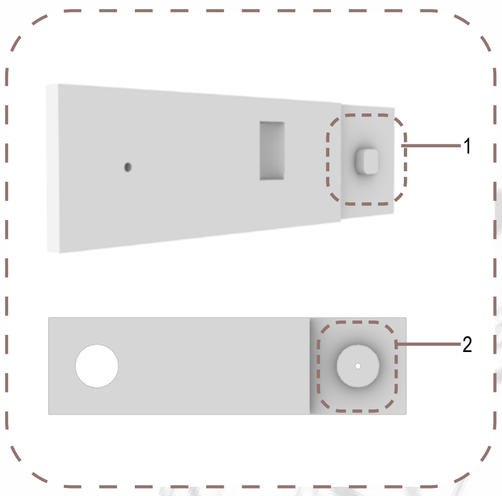


In addressing the optimization of machining paths, we found that when hollowing out large internal cavities, edge-path machining is more effective than the layer-by-layer cutting approach. This method not only significantly improves operational efficiency but also ensures smoother edges.

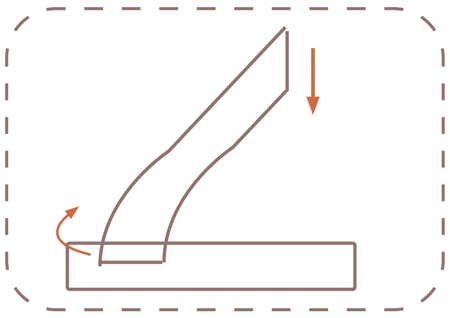




For non-double-sided components, the screw fixation points should first be strategically determined based on the position and movement range of the robotic arm. This ensures that the screws do not interfere with the planned drilling or machining paths, avoiding potential collisions that could damage the tools or the workpiece. Once the fixation points are securely established, single-sided machining can proceed efficiently. This approach not only prevents operational disruptions but also enhances the precision and safety of the machining process.

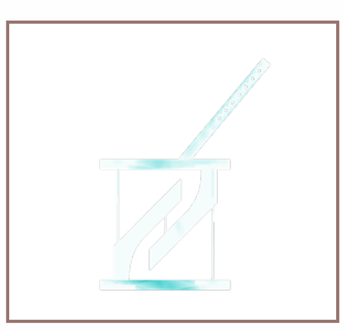
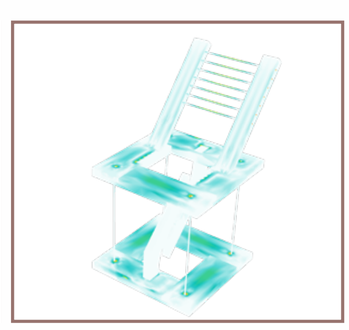
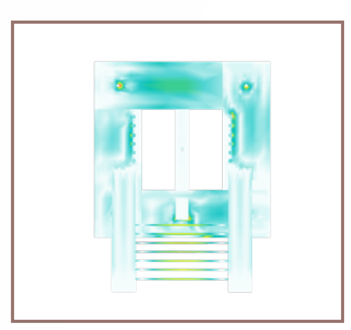


The modified joint design offers several advantages. Cylindrical joints are easier to manufacture using simple tools like drills, unlike rectangular joints that need precise sawing or milling. This simplifies machining, boosts efficiency, and reduces tool precision requirements. Cylindrical joints also distribute stress more evenly, as their continuous surface avoids the stress concentration seen at rectangular joint corners, improving strength and durability. Additionally, cylindrical joints are more flexible during assembly, with fewer alignment constraints, making them easier to insert and adjust compared to rectangular joints. Finally, cylindrical joints better accommodate material variability, minimizing the risk of cracks in wood and offering greater stability in humid or fluctuating conditions.



In the new iteration, we combined two previously separate components into a single integrated piece, reducing the milling process and enhancing the overall strength of the load-bearing structure. To prevent the central suspended load-bearing component from lifting under stress, the force-bearing position of the joint was adjusted. Additionally, for easier milling, the original straight-line design of the component was modified into a curved shape. Considering the direction of the wood's load-bearing capacity, the horizontal wood grain was reoriented to a vertical alignment.

Mechanical analysis of the load-bearing capacity of the chair components based on karamba 3d.