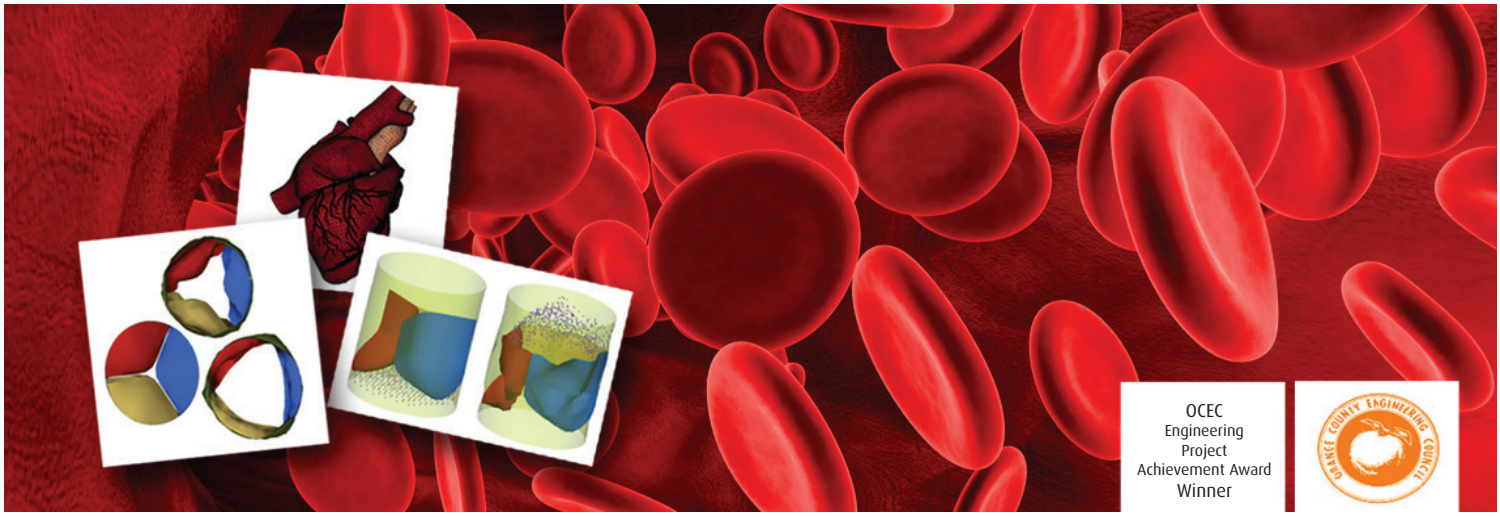
Altair | ProductDesign

case study

Predicting Aortic Stenosis

Award Winning Biomedical Research & Analysis

Aortic valve Stenosis is a heart value disorder that narrows the aortic valve opening due to calcium build up in the leaflets. This prevents the valve from opening properly and obstructs the flow of blood causing the heart to work harder. Finite Element Analysis (FEA) has the potential to allow researchers to study the condition without the need for traditional physical testing. An efficient process was required to make this possible since modeling tissue behavior, back pressure, and the interaction between tissue and blood are highly complex challenges.



solution

Altair ProductDesign led this self funded project to improve the simulation and analysis of heart condition research. Two FE valve models were created, the first was a healthy valve and the second incorporated significant calcification which makes the valve stenotic by not allowing the free forward flow.

The effective orifice areas and stresses evolving during valve opening were compared in order to understand the influence of stenotic leaflets. It was found that the effective orifice area was significantly comprised due to the calcium stiffened leaflets when compared to the healthy valve, showing higher stress at the top of the valve commissures during initial opening. The results compared extremely well with similar hydro-dynamic testing of valves but without the need for lengthy and costly physical testing.

result

This project not only demonstrates the use of simulation to provide a more efficient, cost-effective method of heart valve performance but also ventures into the uncharted territory of simulating congenital heart defects. Innovative simulation will give engineers better insight into how their design performs while reducing physical testing. A rough estimate shows that this process could save an engineer 6 months of development time.

This project won the OCEC Engineering Project Achievement Award.