PO - 0198

POST IMPLANTATION DESIGN OPTIMIZATION OF CORONARY ARTERY STENT

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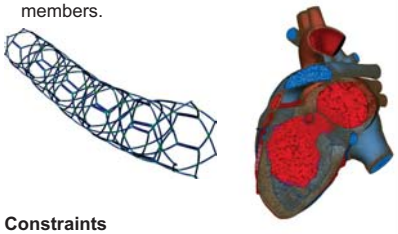
The Aim of the Optimization

The aim of this optimization case was the creation of an automated process for the definition of the optimum stent design regarding

- The radial thickness of the stent,
- The thickness of the stent's members and,
- The length of the stent's longitudinal members.



Constraints

- The constraints of the stent design was the minimum stent diameter value after inflation and
- The maximum plastic strain value after the 3 point bending test.

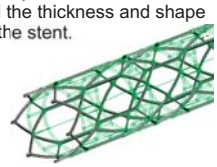
Objectives

- The Objectives of this optimization case was to maintain the maximum possible stent diameter value after the 3 point bending test and also to
- Maintain the minimum possible contact pressure

Stent design parameters definition using:

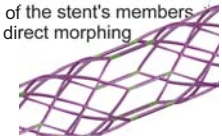
Box morphing

- Numerous boxes and parameters were created that control the thickness and shape of the members of the stent.



Direct Morphing

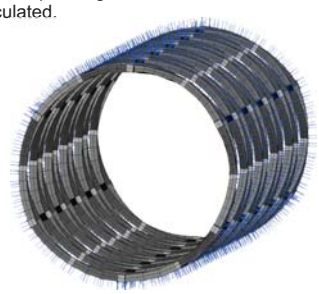
- The internal diameter of the stent as well as the length of some of the stent's members were controlled by direct morphing parameters.



Load cases

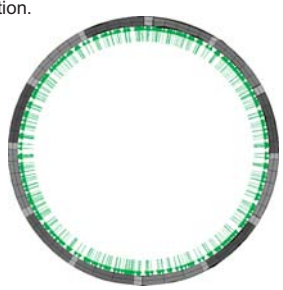
Crimping

- The crimping process was simulated by anode displacement movement.
- During the crimping stage, the stent is plastically deformed while the inner diameter of the model is reduced from the manufactured 1.5mm to 1.0mm followed by a relief step during which the radial recoil was calculated.



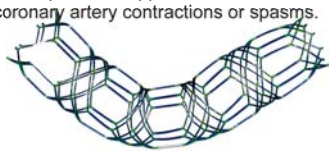
Inflation

- The Inflation step, during which the inner diameter of the stent is increased from 1.0mm to 2.0mm, was simulated using a distributed Pressure load, equal to 10atm of air pressure. A relief step followed the inflation.



3-point Bending

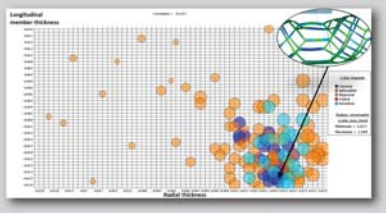
- A 3-point bending test was simulated in order to evaluate the design under moment loads (0.15N) that are applied to stents due to coronary artery contractions or spasms.

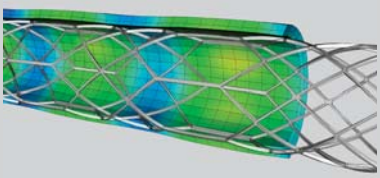


Results

The Results of the optimization indicated a specific optimum design that achieved the maximum value of inner diameter after the bending test. At the same time the target for the inflation step has been reached, and the plastic strain and the contact pressure remained below the failure values.
The Optimization problem resulted in optimum data for this process of automated design definition using morphing according to multiple constraints and objectives.

	Diameter after inflation (mm)	Diameter after bending (mm)	Plastic strain
Initial Model	1.569	1.518	15%
Target Values	>1.95	1.7<x<1.95	<18%
Optimum Result (id 54)	1.973	1.95	16%





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