IGA-based computational methods to simulate shape-changing artery stents

UNIVERSITÀ DEGLI STUDI FIRENZE

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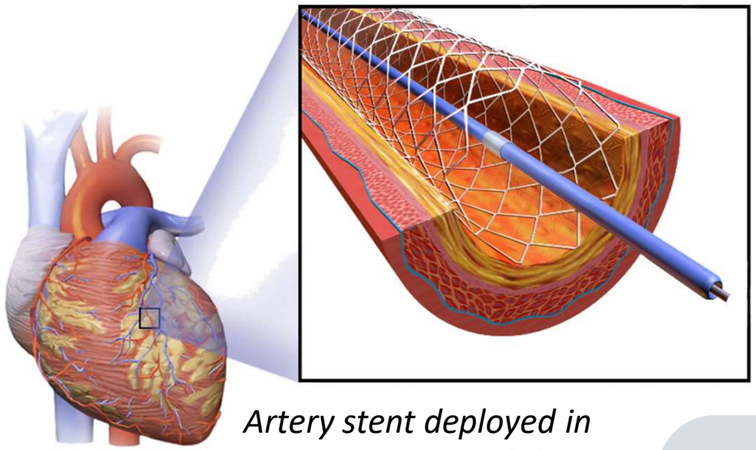
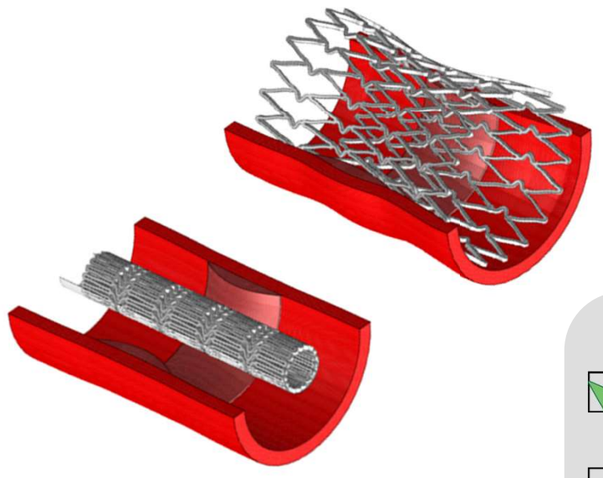


Artery stent deployed in a coronary vessel [1]



Shape-changing stent procedure inside the vessel [2]

OBJECTIVE

To develop a **powerful computational model** based on **isogeometric analysis** (IGA) to model **shape-changing**, patient-tailorable **stents**, suitable for 4D printing.

TOOLS and METHODOLOGY

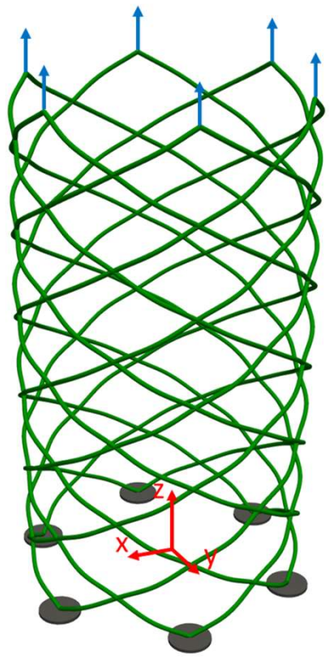
IGA, especially if combined with the collocation method (**IGA-C**), represents a very **appealing method** to achieve unprecedented efficiency and geometrical accuracy with respect to standard FEM (Finite Element Methods).

ACHIEVED GOALS and NEXT STEPS

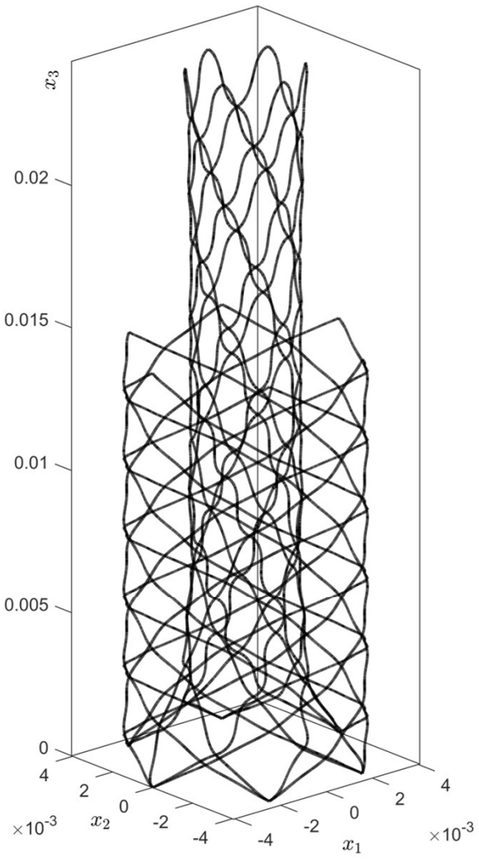
- [x] To model and analyse accurately and efficiently very **complex structures** with **IGA-C**;
- [ ] Use of nonlinear thermo-responsive constitutive model for **programmable materials** (4D);
- [ ] Simulation of **patient-tailored devices**.

NUMERICAL APPLICATIONS

Analisys of a real artery stent by adopting an improved IGA- C formulation *[3]*



Stent structure



Deformation of the stent

REFERENCES

[1] "Blausen 0034 Angioplasty Stent 01.png" by BruceBlaus. Blausen.com staff (2014). "Medical gallery of Blausen Medical 2014". WikiJournal of Medicine 1 (2). DOI:10.15347/wjm/2014.010. ISSN 2002-4436, is licensed under CC BY 3.0 / Modified from the original.

[2] Auricchio F, Conti M, Morganti S, and Reali A. "Shape memory alloy: from constitutive modeling to finite element analysis of stent deployment". CMES 2010.

[3] Ignesti D, Ferri G, Auricchio F, Reali A, and Marino E. "An improved isogeometric collocation formulation for spatial multi-patch shear-deformable beams with arbitrary initial curvature". CMAME 2023.

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