Next-Generation Neurovascular Stents: Design Strategies Linked to Modern Manufacturing Techniques

Daniel Frape1 and Fernanda Zamboni1,2,3

1. School of Engineering, University of Limerick, Limerick, IRELAND.

2. Health Research Institute (HRI), University of Limerick, Limerick, IRELAND.

3. Bernal Institute, University of Limerick, Limerick, IRELAND.

22341331@studentmail.ul.ie

Introduction

Neurovascular stents are designed to treat complex cerebrovascular conditions such as aneurysms [1]. Continued development of novel stent designs is essential to improve deployment precision in the brain's delicate vasculature and to accelerate endothelialisation, which supports vessel healing while lowering the risks of clot formation and stroke. These devices represent a major advancement in minimally invasive therapy and vascular reconstruction, offering safer and more effective alternatives to open surgery.

Objective

This work aims to generate neurovascular stent designs tailored for manufacture using 1) braiding, 2) laser cutting, and 3) 3D printing.

Methods

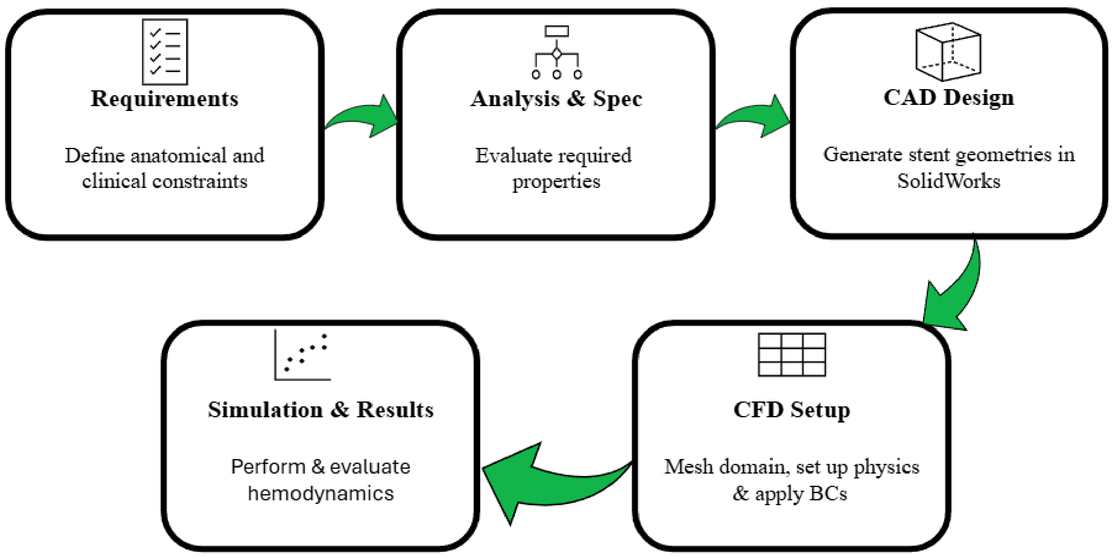


Figure 1. Methodology Overview.

Design Variants

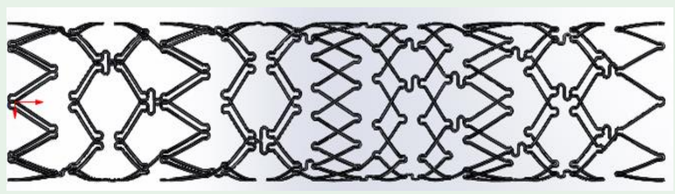
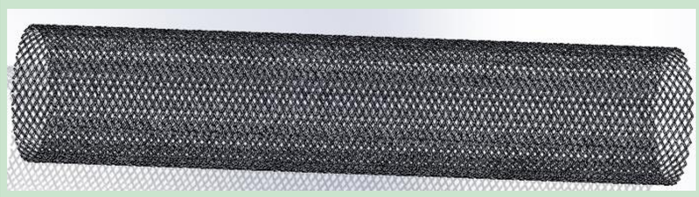
Manufacturing Process	CAD Design
Braiding	
Laser Cutting	
3-D Printing	

Table 1: Manufacturing process and generated designs

Results

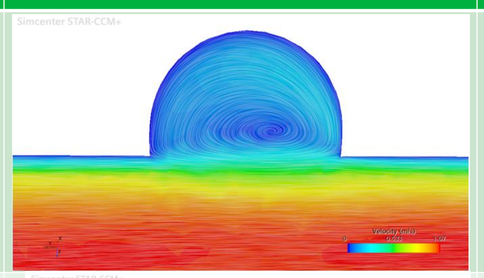
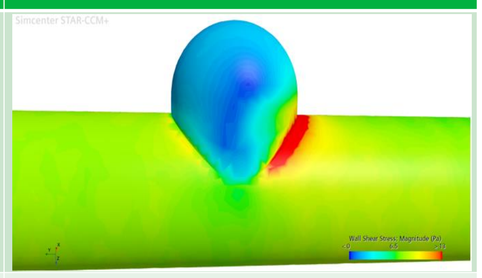
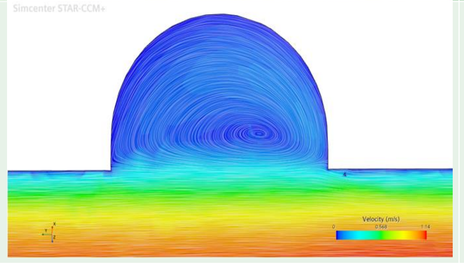
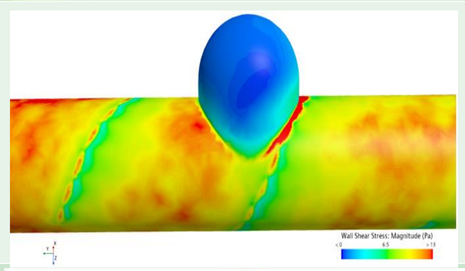
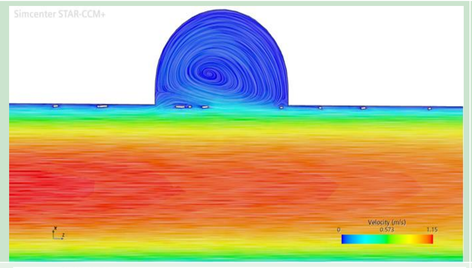
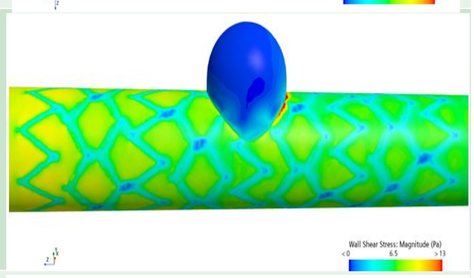
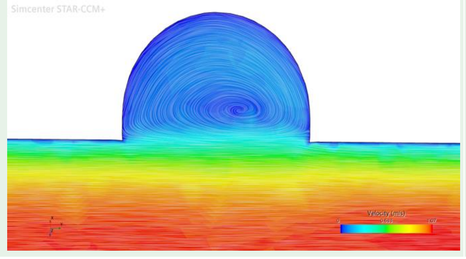
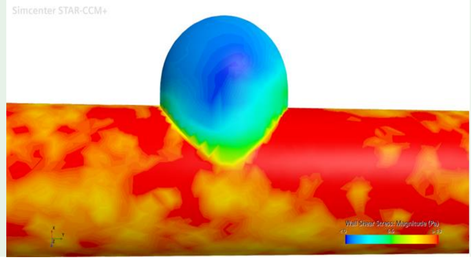
	Velocity & Vorticity	Wall Shear Stress
Control		
Braided Stent		
Laser Cut Stent		
3-D Printed Stent		

Table 2: Comparison of CFD results

Conclusion

This project outlines emerging neurovascular stent designs optimised to promote faster endothelialisation and reduce clot risk while defining key geometric, material, and manufacturing considerations.

References

- [1]: Qureshi, A.I. (2004) 'Endovascular treatment of cerebrovascular diseases and intracranial neoplasms', The Lancet, 363(9411), 804–813.

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