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Modelling an Improved NOL Ring Test Using a Reduced Volume Method for the Characterisation of Composite Cylinders

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Martinus P. Widjaja, Sébastien Joannès, Anthony R. Bunsell, Georg Mair, Alain Thionnet. Modelling an Improved NOL Ring Test Using a Reduced Volume Method for the Characterisation of Composite Cylinders. ICCM 22 - 22nd International Conference on Composite Materials, Aug 2019, Melbourne, Australia. <hal-02316280>

HAL Id: hal-02316280

<https://hal.science/hal-02316280v1>

Submitted on 15 Oct 2019

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MODELLING AN IMPROVED NOL RING TEST USING A REDUCED VOLUME METHOD FOR THE CHARACTERISATION OF COMPOSITE CYLINDERS

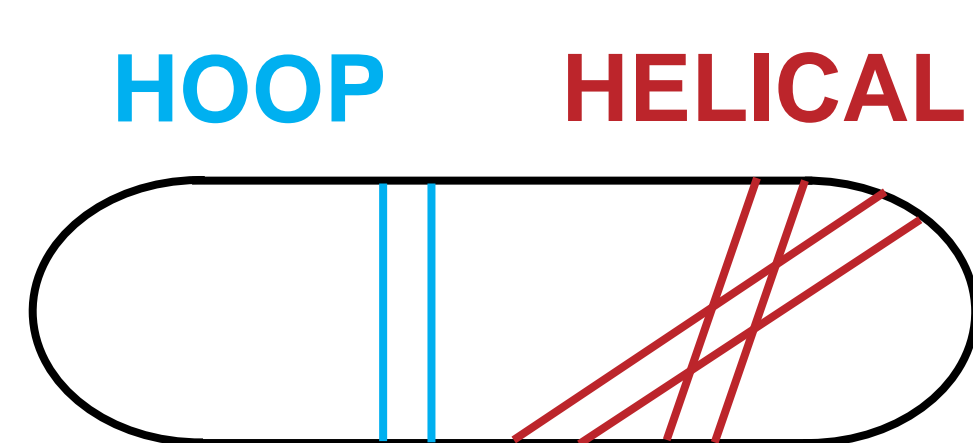
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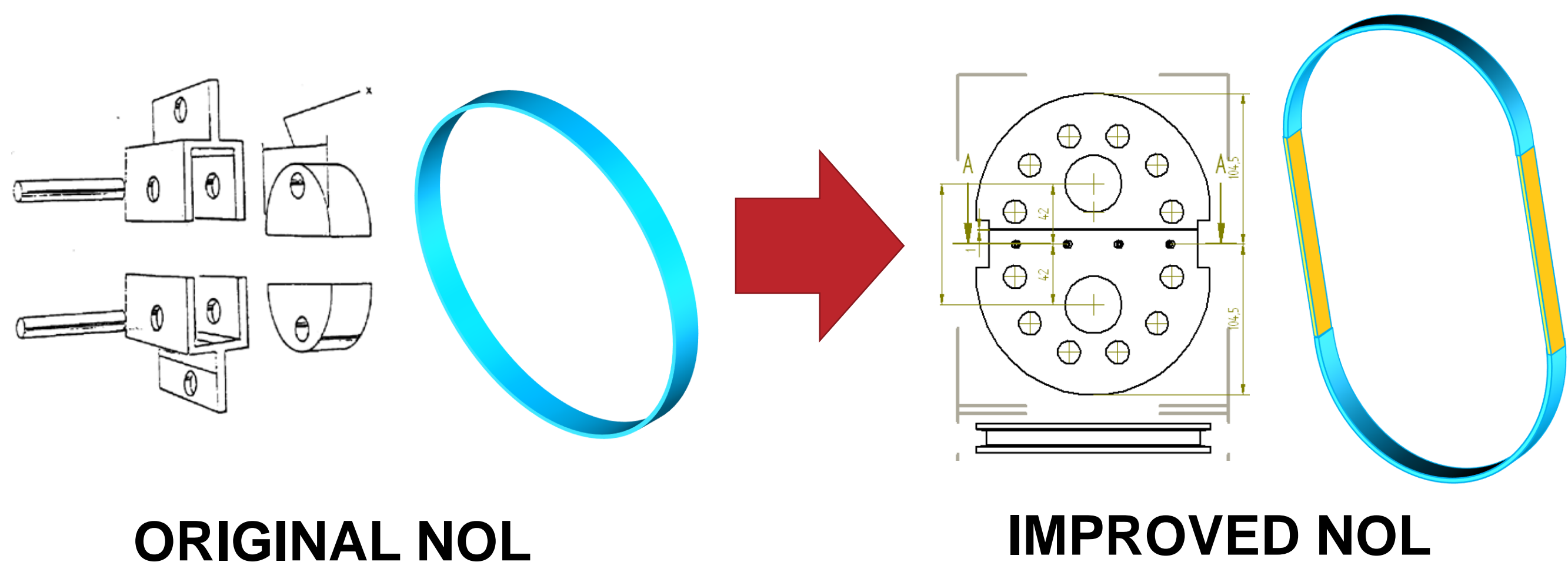
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Motivation



- The hoop ply holds most of the load
- The strength of CPV can be characterised by a part of a cylinder

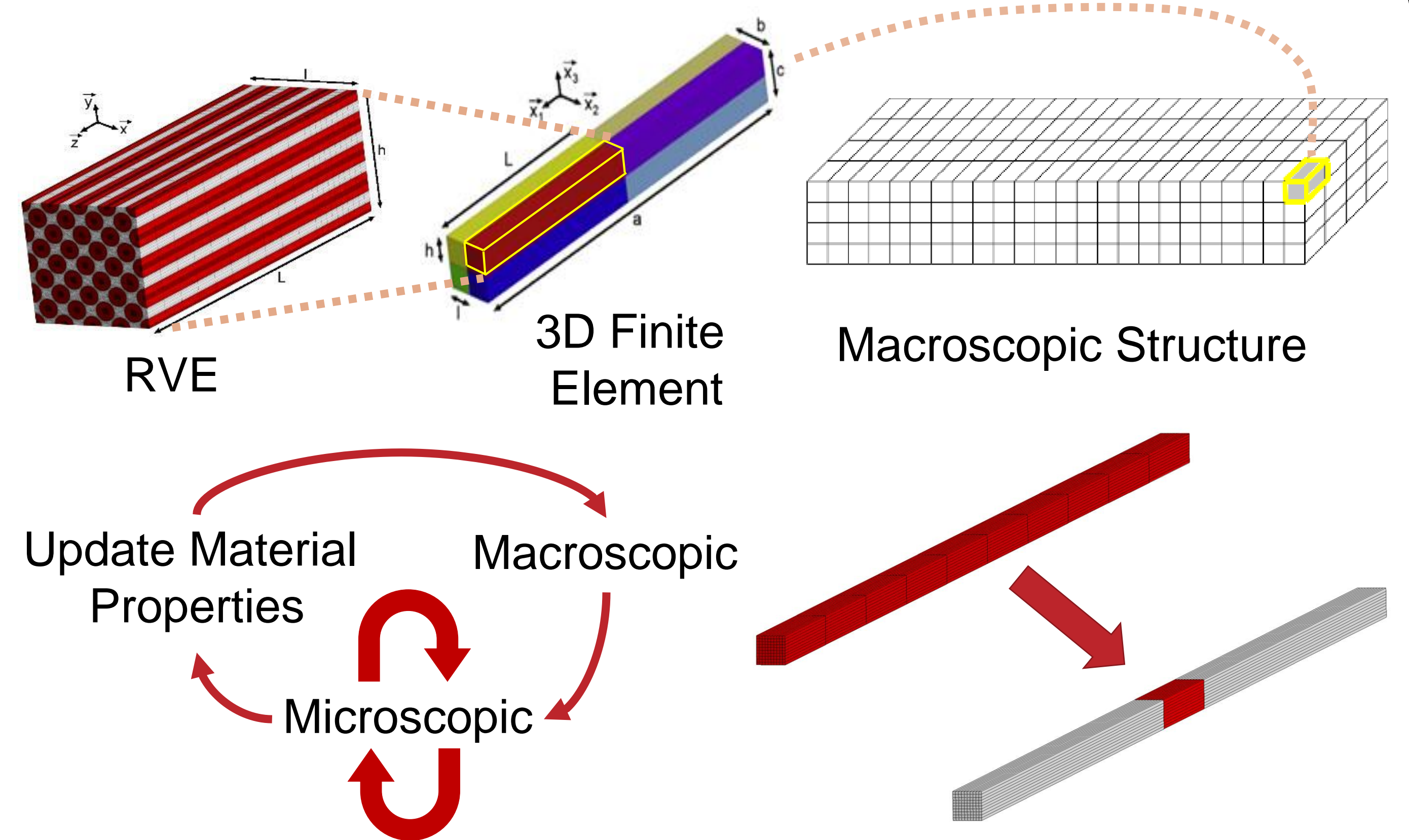


ORIGINAL NOL

IMPROVED NOL

- Include the effect of filament winding -
- Ensure the failure caused only by the tensile load -

Methodology

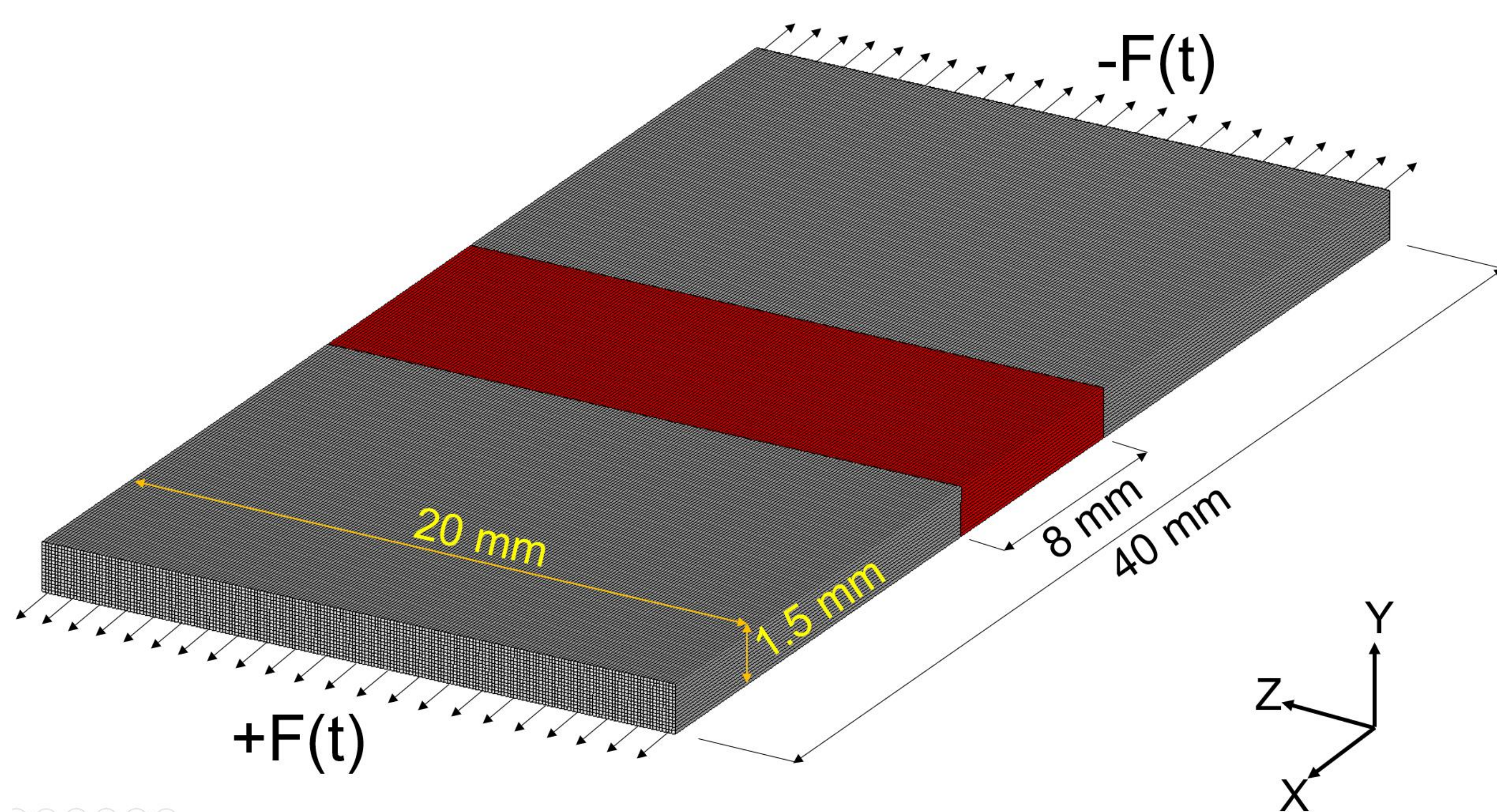


- The number of elements can be reduced based on the evaluation of the reduced volume method -

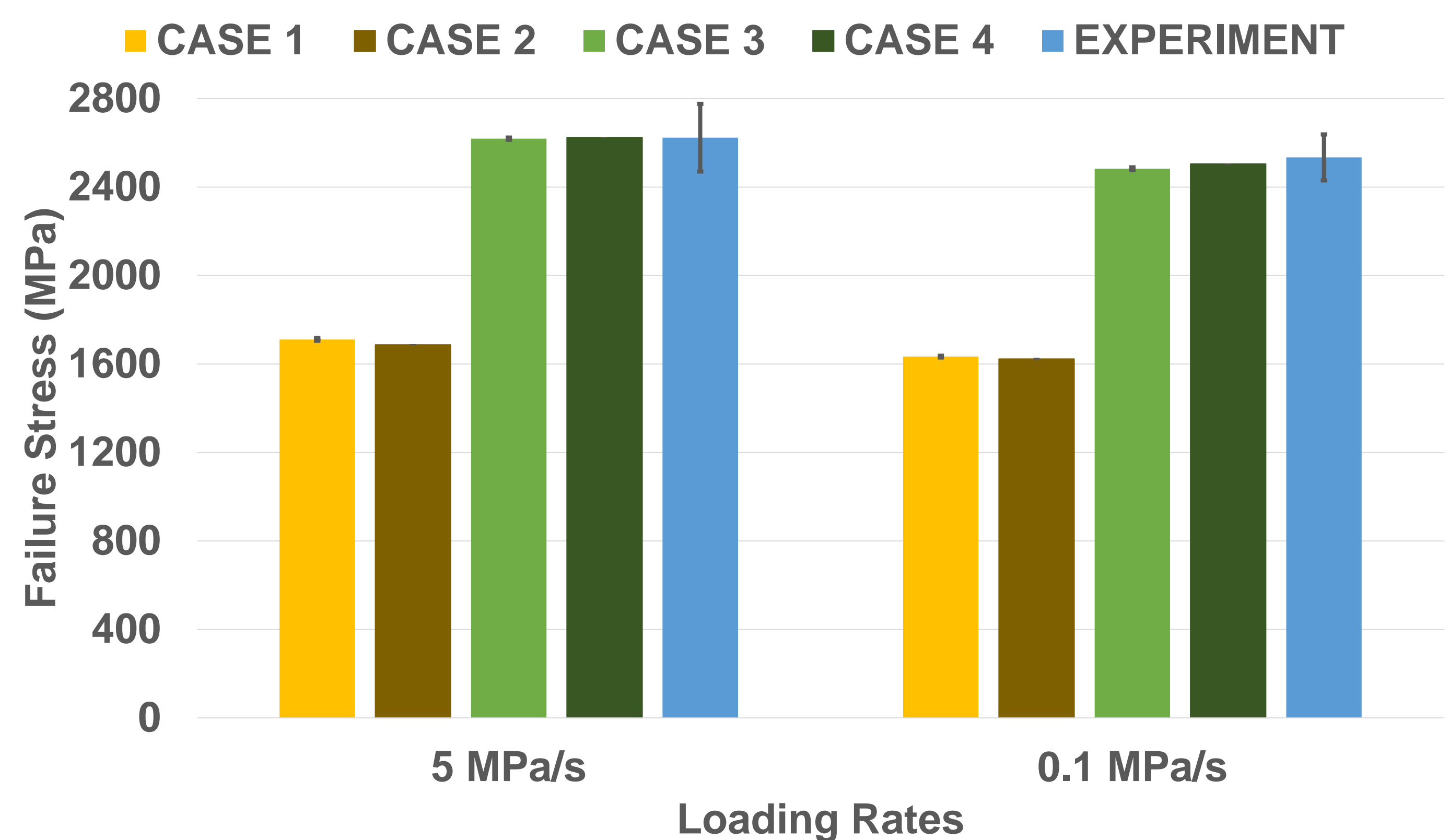
Comparison Study

- The multiscale model applied only on the red region -

- The rest modelled with linear elastic properties -



Cases	Fibre Vf (%)	Sectional Area (mm ²)	Cases	Fibre Vf (%)	Sectional Area (mm ²)
1	35	30	3	55	30
2		40	4		40



Conclusions

- Case 3 has given the most favourable comparison result
- Using the reduced volume method, the strength of large composite structures can be evaluated more effectively
- The model showed similar tendency to the effect of time

References

- [1] S. Blassiau, A.R. Bunsell and A. Thionnet. Accumulation processes and life prediction in unidirectional composites. The Royal Society A, 463:1135-1152, 2007
- [2] M.P. Widjaja, S. Joannès, A. Bunsell, G. Mair and A. Thionnet. The application of a reduced volume method for the simulation of the characterisation of a carbon fibre pressure vessel. Proceedings of ECCM, Athens, Greece, 2018.

Acknowledgements

The research leading to these results has been done within the framework of the FiBreMoD project and has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 722626



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