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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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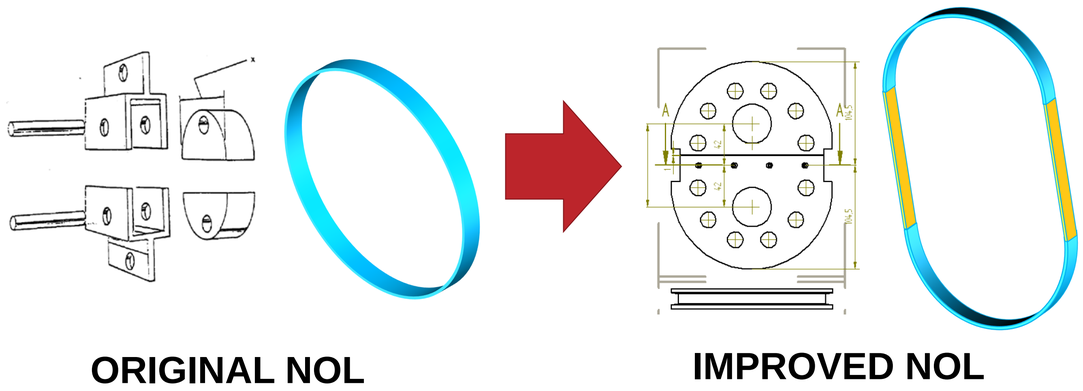
Motivation

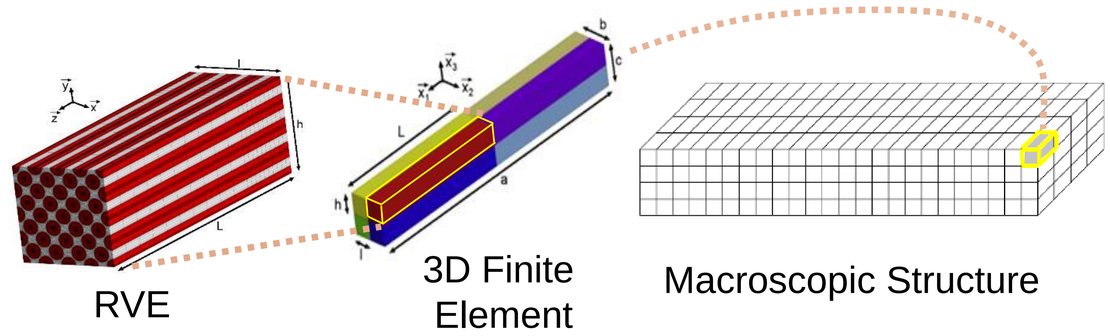
- The hoop ply holds most of the load
- The strength of CPV can be characterised by a part of a cylinder

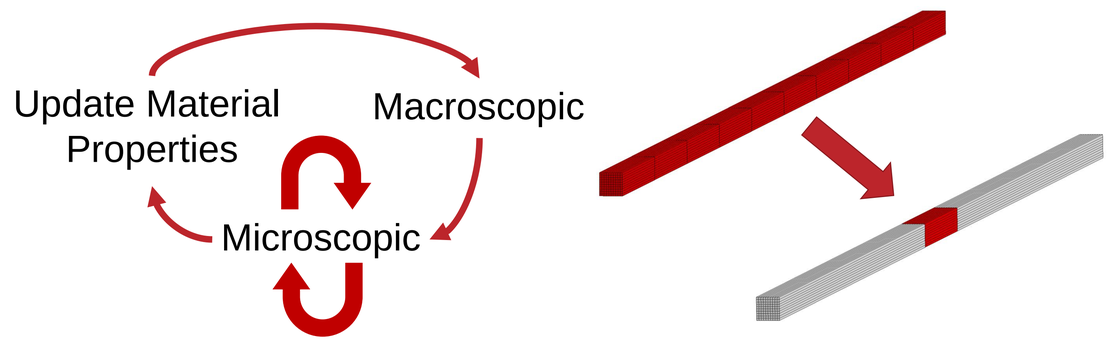


ORIGINAL NOL **IMPROVED NOL**

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

Methodology



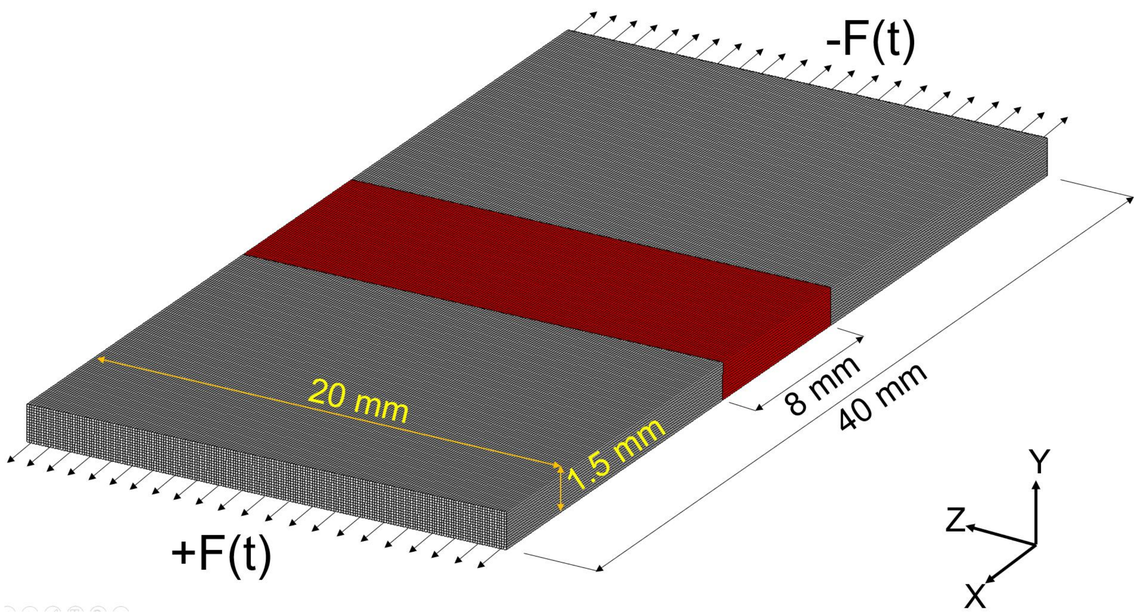


- The number of elements can be reduced based on the evaluation of the reduced volume method -

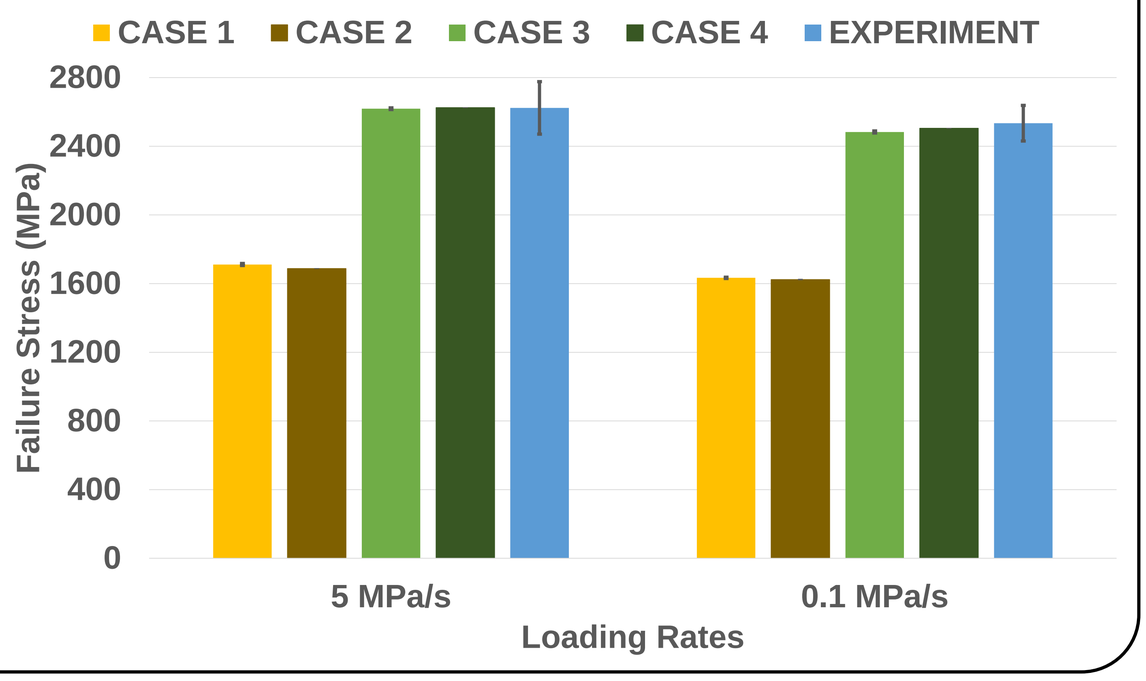
Comparison Study

- 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. Joannes, 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.

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