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G2TRC
GAS TURBINE AND TRANSMISSIONS RESEARCH CENTRE

Compressor Blade Tib Rubbing and Abradable Characterisation

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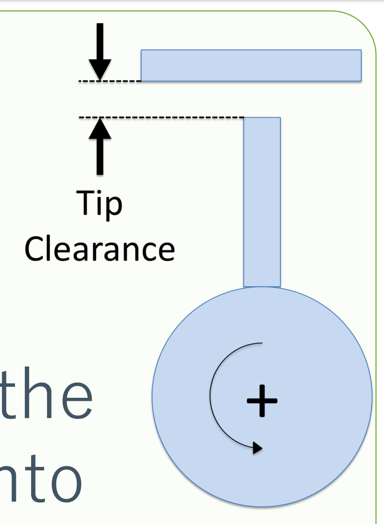
Introduction



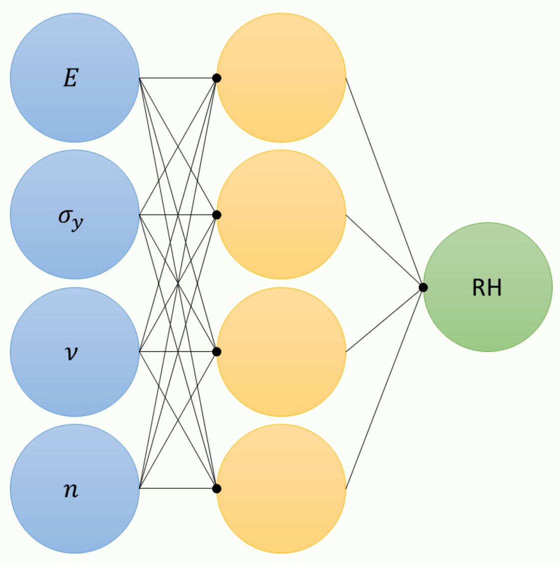
To improve aeroengine efficiency, the compressor blade tip clearance with the casing needs to be minimised. Inevitably this leads to more frequent blade-casing interactions during revenue service. To reduce the severity of these interactions a sacrificial abradable liner is sprayed onto the internal casing surfaces. However, there is uncertainty surrounding the abradable, blade-casing interactions, and the subsequent damage mechanisms. This work will provide improved understanding and design and lifing rules for blades undergoing incursion events.

Objectives

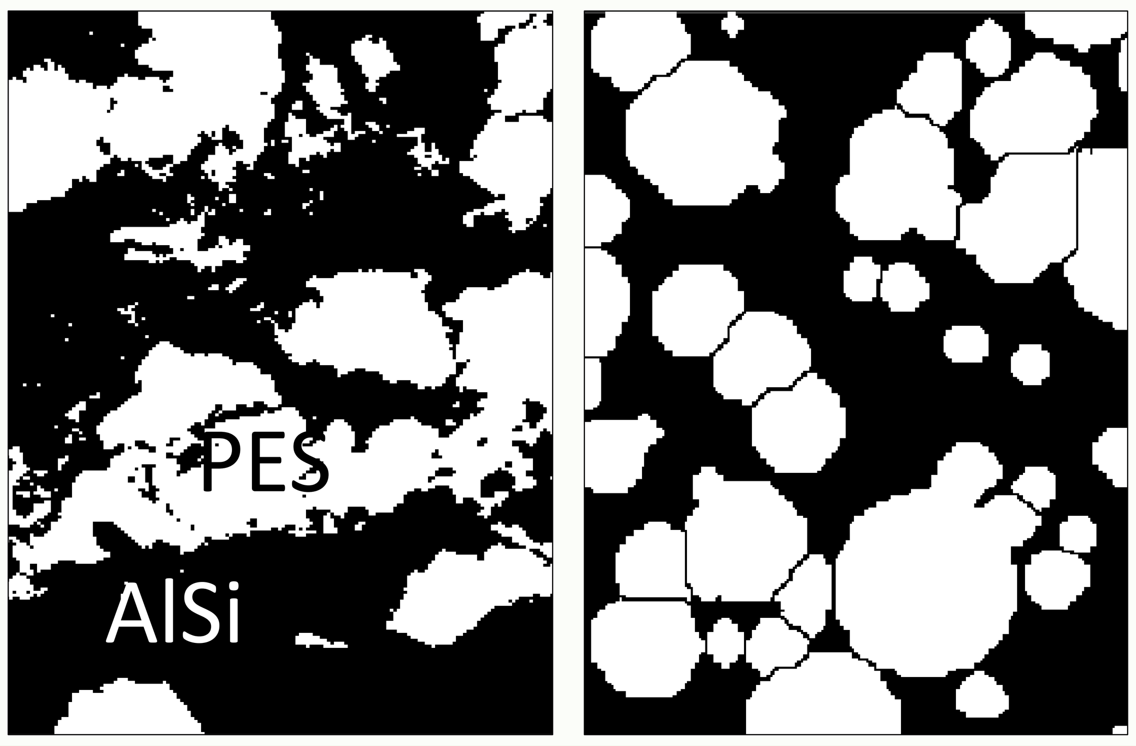
1. Improve current modelling capabilities.
2. Validate models using test rig at TU Dresden.
3. Post-mortem analysis of blades and abradables to identify failure modes.

Methodology

These is uncertainty in the mechanical response of AlSi-Polyester (AlSi-PES) abradables due to poorly defined properties, so an inverse Particle Swarm Optimisation (PSO) has been used in conjunction with a Neural Network (NN) to quickly find key homogenised material properties based on Rockwell Hardness (RH) alone. Constituent material properties are to be found by a similar method using tensile testing of RVEs.

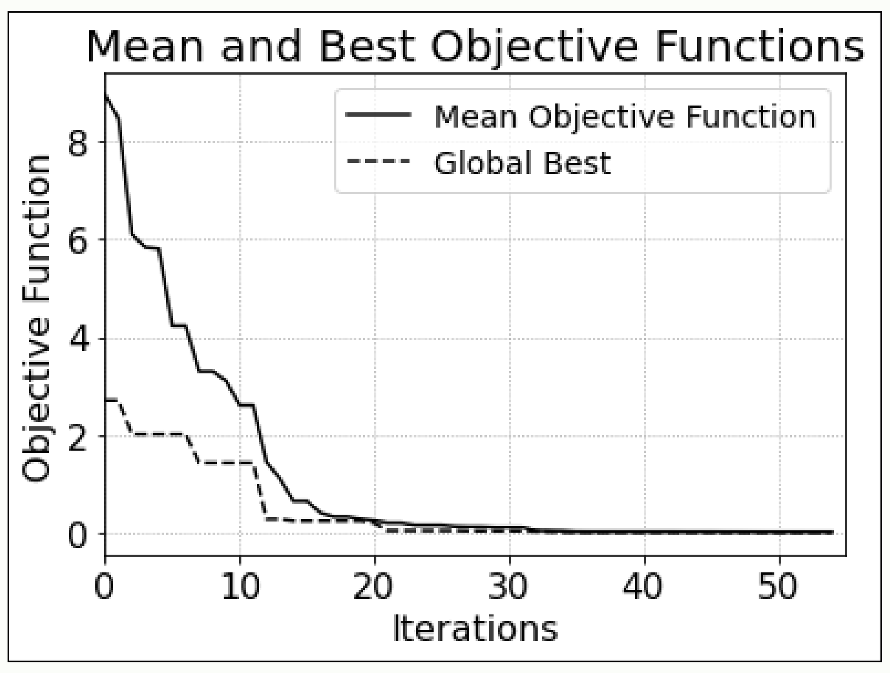


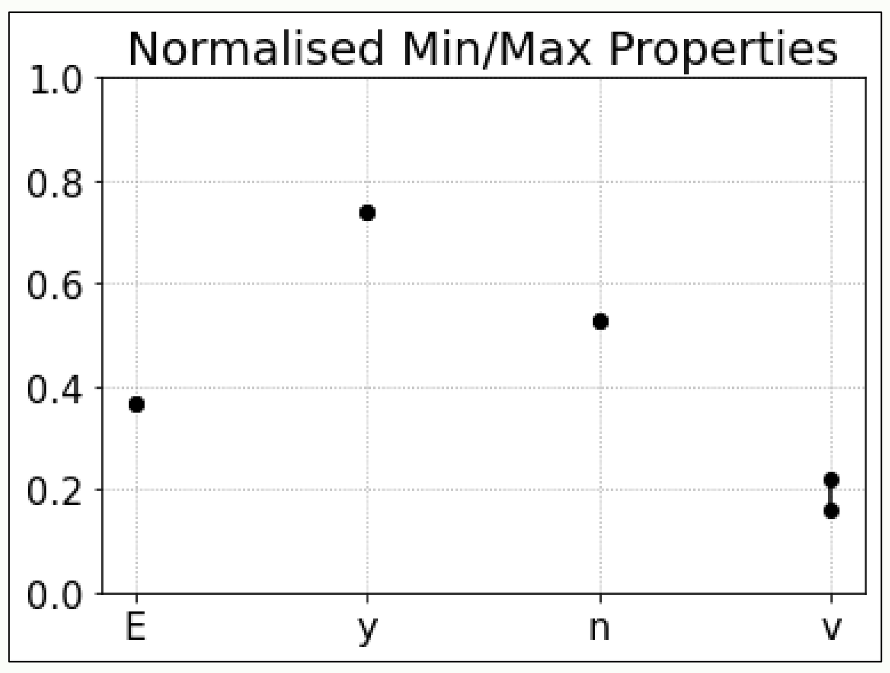
To define the RVEs, micrographs of abradables with known hardnesses have been analysed to obtain key information such as phase volume fractions and particulate sizes.



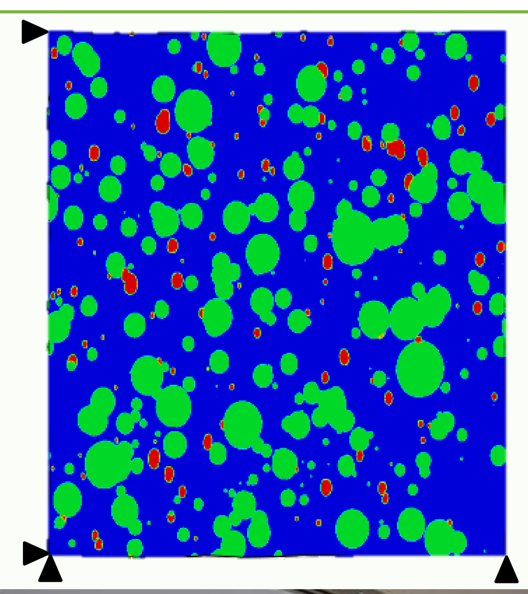
Results

Homogenised AlSi-PES properties accurately predicted and good convergence is seen amongst all particles.



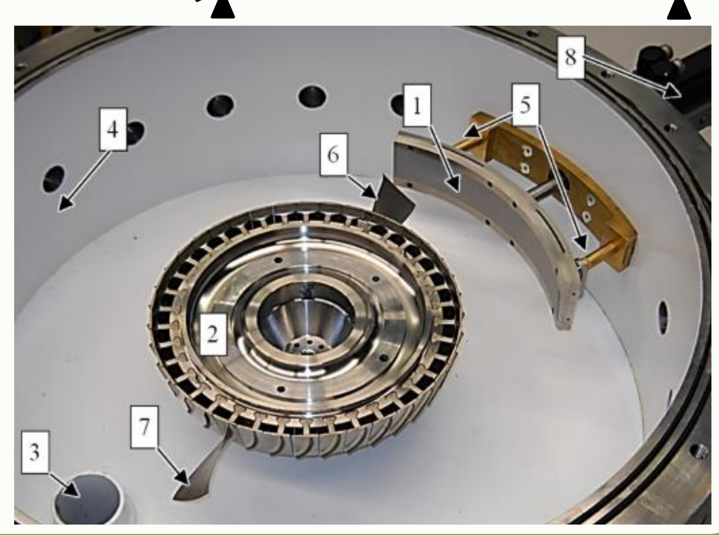


Ongoing



1. Constituent properties to be obtained via tensile testing in an additional optimisation procedure, and the newly defined properties used in blade-casing interaction simulations.

2. Blade-casing interaction tests to be ran at TU Dresden, with an emphasis on interaction history and two interactions per revolution.



Conclusions

- A method for determining AlSi-PES material properties based on RH has been created, and a method for finding constituent properties is being developed.
- A series of simulated blade-casing interactions are to be ran and verified against experimental data. This will ultimately enable abradables to be tailored for specific blade geometries.