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DIGITAL GEOMETRY TO SUPPORT A DIGITAL TWIN FOR A GAS TURBINE

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Industrie 4.0, Digitalisation", the Digital Twin, Data-driven design & manufacturing are set to revolutionise the way we do business. The role of a Digital Twin is to represent a system, in our case a gas turbine, over its whole life from design through manufacturing, service, overhaul & maintenance with data-driven feedback throughout to improve the economic and environmental performance of the system." This paper asks the question: What would it take to make a Digital Twin real.

A Digital Twin with physics-based simulation at its heart will need to be able to represent & manage huge geometries over scales ranging from individual components like gas turbine blades through to assemblies and on to systems at the level of complete power plant. This will need to be distributed across parallel computer resource, perhaps the Cloud, supporting huge, conjugate, aero-thermal-mechanical simulations (on huge meshes). Data-driven feedback derived from field data, in-service monitoring, damage, degradation, etc. will need to be incorporated into improved design & manufacturing – via the geometry. Traditional BREP CAD modelling will struggle to satisfy these demands.

This paper will describe a revolutionary approach to support a Digital Twin – a Digital Geometry solid modelling kernel. This kernel can support large geometries of arbitrary complexity, respond straightforwardly to data-driven feedback on manufacturing variability, in-service wear, corrosion, erosion, damage, etc. – *and* scales in parallel across multi-core and cloud computer resource. Examples will be given including a simulation of turbine blade performance degradation associated with erosion & damage.