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COSIMULATION STRATEGY FOR CONJUGATE HEAT TRANSFER APPLIED TO COOLED TURBINE BLADE

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Computing the precise thermal field seen by a complex high pressure turbine blade during its life is a key challenge for aircraft and helicopter enginess builder. In fact, it is strongly linked to both the efficiency and the lifespan of the product. However, the internal and external flows that develop around and through the blade have Reynolds numbers that differ by several orders of magnitude. As a consequence, the convection coefficient strongly varies between different zones of the turbine blade. In addition, the characteristic time scale of the engine cycle (some hours), and the transient temperature inside the solid and the fluid flow (some seconds) also differ by orders of magnitude which add more complexity to the simulation.

A framework allowing a flexible partitioned approach is derived from [1] to compute the thermal fields resulting from heat transfer using HPC techniques. It allows coupling the finite volume code elsA with the finite element code Zset, or the finite volume code Fluent with Zset. Advantages of this technique are highlighted, discussed and compared to a monolithical approach using Fluent alone. In addition, the flexibility of this framework permits the easy study of the temporal coupling algorithm required to simulate a full engine cycle [2] and the different coupling coefficients used that change the coupling algorithm efficiency [3].

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