

**NUMERICAL CALCULATION OF THE PROCESS PARAMETERS, WHICH OPTIMIZE THE GAS TURBINE BLADE COATING PROCESS BY THERMAL SPRAYING, FOR GIVEN SPRAY PATHS**

**Dr. Martin Balliel**

ALSTOM (Switzerland) Ltd  
Baden-Daettwil

The application of metallic bond coats and thermal barrier coatings by thermal spraying are commonly used technologies in manufacturing of turbine hot gas parts such as blades, vanes, heat shields and burner cans. For the coating thickness and porosity strict limitations are imposed, especially for blades and vanes. Those requirements cannot be easily met with the existing hardware and conventional process control. Among the major challenges in manufacturing is:

- The complex component and spray gun shapes limit the accessibility of certain areas of the component surface. The necessity to spray those areas at unfavourable angles and overspraying of the shading and adjacent surfaces are the major consequences, which result in non-uniform coating thickness and porosity.

Therefore, the control of the position and motion of the gun, taking into account the component geometry, are key issues, which are addressed in this research project. The research project targets the following points:

- The development of criteria and strategies for the optimisation of the coating process, which include the coating thickness, porosity distributions and the total coating time as parameters of the objective function.
- The development of methods for the optimisation of a given spray path for complex 3D shapes by taking into account equipment, process and tooling limitations,

This is to ensure a coating process with the following properties:

- Coating thickness distribution within the given tolerance, which is determined by the quality standards of ALSTOM
- Acceptable spray angles for the entire coated surface(s) to control the porosity distribution and the surface morphology of the coating within the given tolerances, which are defined by the quality standards of ALSTOM

The optimisation is expected to allow for decreased development times and increased process yields as well as reduced rework leading to an increase in production capacity.