

## Preface

Micro-gasturbines have experienced a growing interest during the last decade. Their large energy density (kWh/kg) makes them attractive for portable power units as well as for propulsion of small airplanes (UAV). They are also of interest for distributed power generation in applications where heat and power generation can be combined. The need for high performance in both applications is at the origin of a worldwide interest and research on micro-gasturbines and the motivation for the present lecture series.

Scaling is a common technique to define larger or smaller geometries with similar characteristics. However a simple scaling of a high performance large gasturbine will not result in a good micro gasturbine as it is perturbed by the large change in Reynolds number, the massive heat transfer between the hot and cold components (negligible in large machines) and geometrical restrictions related to material and manufacturing of miniaturized components.

This course notes intend to give a better insight into the problems that result from the small dimensions of micro and nano-gasturbines and provide more detailed information on:

- The heat fluxes, resulting from the large temperature differences and small dimensions, and their impact on flow and thermodynamic performance.
- New oil free bearings, withstanding the very high temperatures of the components and capable of operating at the very high RPM (over 10.6 rev/min) that are needed to provide the required pressure ratio in small rotors.
- Alternative cycles and advanced compact heat exchangers to maximize cycle efficiency and minimize the exhaust temperature.
- Small combustors requiring special designs because of the short residence time and non-conventional fuels.
- New materials and small dimensions imposing the use of new unconventional manufacturing techniques.
- New electrical generators and motors capable of operating at the very high RPM and the power control.

Each of these topics has challenging problems and is the object of intensive research. Recent progress and developments in Asia, Europe and USA, are presented and experience is shared.

Application for propulsion and combinations with fuel cells are commented and illustrated.

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