Cranfield
Aerospace

Continuing Professional Development

Gas Turbine Performance and Introduction to Propulsion Simulation Using NPSS®

11-15 September 2017

In association with:

SwRI®

A one-week course covering the basic principles underpinning the design, operation and behaviour of gas turbines and an introduction to NPSS®.

NPSS is a simulation software used in aerospace applications for modeling air and liquid propulsion systems and for the integrated analysis of aerospace vehicles.

Course overview

The gas turbine engine is a very complex device. Its high power to weight ratio has made it the propulsion system of choice in aircraft applications. It is also used extensively in the oil, gas, power and process industries. An understanding of the basic principles underpinning its design, operation and behaviour is essential for all engineers involved in the development, production, procurement and use of gas turbines.

The NPSS portion of the course is divided into seven modules that cover the basic concepts and features of NPSS. Each module is accompanied by practical exercises.

Course objectives

This course will provide you with an understanding of how different types of gas turbine produce useful power and how their output is influenced by a very wide range of operating conditions. The three major categories of gas turbine applications are covered, civil aviation, military aviation and mechanical power applications. On completing the course, you should be able to understand the influence of mission on the choice of gas turbine cycle and how gas turbines behave in a very wide range of operating conditions.

Those completing the NPSS track should also be able to create and run system models using the Introduction to Propulsion Simulation NPSS software.

Who should attend?

The course is intended for graduates of engineering, science or mathematics who are involved in the gas turbine or associated industries. Previous industrial experience is desirable.

The NPSS portion of the course is intended for engineers responsible for modeling or analysing the performance of thermo-dynamic and fluid/thermal systems.

Companies who have benefitted from our gas turbine courses

- Aeronautical Research Center
- Centre d'Ingenierie Thermique
- EDF Energy
- Exxon Mobil
- Ferrovial Agroman UK Ltd
- GE
- GKN Aerospace Sweden
- Korea District Heating Corporation
- MTU Aero Engines
- Perenco
- Petrobras
- RWEnPower
- Saudi Arabian Oil Company
- Siemens
- TAE

> "The standard of course lectures is what makes this so superior. Lecture notes and content is spot on too. Exceeded personal objectives."
>
> **Richard Fry**
> Perenco,
> Gas Turbine Appreciation course, previous participant

Course topics

The objective of the course is to give detailed insight in these four key topic areas:

Gas turbine aerothermodynamics

This section comprises the delivery of basic gas dynamics including isentropic flow, an explanation of non-dimensional parameters and a description of the Joule Cycle. The processes of compression, combustion and expansion in turbines and nozzles are outlined, within a thermodynamics framework. The two main applications of the gas turbine, jet engines and shaft power output, are explained. The concepts of thermal and propulsive efficiencies are introduced. The concept of the turbofan is explained.

Design point performance assessment

The influence on engine output of turbine inlet temperature, overall pressure ratio, bypass ratio and fan pressure ratio is explained. This description is made by means of SFC versus Specific Thrust or Power Charts. The side-effects of the selection of these parameters are also explained and the resulting choices in suitability for a mission highlighted. The concept of growth variants of a power plant is discussed. Different engine designs are described.

Introduction to performance simulation using NPSS

The basic concepts and features of NPSS are covered beginning with the anatomy of an NPSS model; the NPSS Solver methodology and Solver object details; variables, arrays, and tables; creating elements; functions; units; and the final project developing a complete model and obtaining results.

Off-design performance

This section contains a description of component characteristics and how these components interact to determine the behaviour of the engine. This explanation is given at a simplified level for an understanding of the principles involved and at a more detailed level which is illustrative of the simulation methods in widespread use in the industry today. On a macroscopic level, the effect of different inlet conditions on gas turbine performance is explained. This includes altitude, hot day and flight speed. In addition the behaviour of the engine is discussed with reference to changes in power output.

Course speakers

Professor Pericles Pilidis
Head of Power and Propulsion Department

Professor Pilidis completed a doctorate in Gas Turbine Engineering at Glasgow University. His first employment was with the British Caledonian group in the gas turbine overhaul business. He joined Cranfield in 1986 as a lecturer and was promoted to the Director of the Thermal Power Master course and was head of the Gas Turbine Engineering Group. In 2006 he was appointed Head of the Propulsion Centre and also heads the Turbomachinery and Icing Group.

For many years he has applied performance modelling techniques to understand issues of relevance to operation, maintenance and control.

Professor Pilidis has organised and contributed to many international teaching and applied research programmes in the gas, oil and aviation industries. Much of his research has been focused on the needs of users of equipment in various countries. He has acted as a consultant to several organisations and his active contributions have resulted in many international honours.

Mr David Ransom
Manager, Southwest Research Institute

Mr Ransom is a Manager at Southwest Research Institute, in San Antonio, Texas, USA. His professional experience over the last eighteen years includes engineering and management responsibilities at Boeing, Turbocare and Rocketdyne. His research interests include machinery for propulsion and energy applications. He is experienced in the areas of rotordynamics, structural dynamics, finite element analysis, fluid-thermal systems, root cause failure analysis, modeling and simulation, and test rig development. He also manages the NPSS Consortium, developing simulation tools for air and liquid breathing engine systems. He has authored 24 technical papers in the field of rotordynamics, rocket propulsion and root cause failure analysis. David received his M.S. (Mechanical Engineering, 1997) and his B.S. (Engineering Technology, 1995) from Texas A&M University. He is also a licensed Professional Engineer in the State of Texas.

Key information

Fees
£1,710

10% discount when more than five delegates are booking from one site of one organisation.

Accommodation
£480

Accommodation is on a full-board basis from the evening before the course commences until the afternoon of the last day. The accommodation fee includes breakfast and dinner.

Location and travel details
Cranfield University is located about halfway between London and Birmingham, and on the outskirts of Milton Keynes. Junctions 13 and 14 of the M1 are five minutes away and Milton Keynes railway station is 20 minutes by taxi. London Luton, Stansted and Heathrow airports are 30, 90 and 90 minutes respectively by car, offering superb connections.

To book now, contact:
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