PROOSIS is a stand-alone, flexible and extendible object-oriented simulation environment for modelling gas turbine engines and other systems (control, electrical, thermal, hydraulic, mechanical, etc.). It was originally developed by Empresarios Agrupados Internacional S.A. and an aeronautics consortium of European universities, research institutes and corporate companies. It is based on EcosimPro, the European Space Agency’s preferred tool for rocket propulsion, environmental control and life support systems, among others.

PROOSIS has an advanced Graphical User Interface and uses a high-level, “engineer-friendly” object-oriented language (EL) for modelling engine systems and state-of-the-art technologies in areas such as numerical solvers, non-causal modelling of reusable libraries, XML file formats, map handling etc.

Any gas turbine engine configuration or system can be constructed graphically by “dragging-and-dropping” the required component symbols from the included libraries to a schematic window. Using EL, users can also create new components and libraries, or extend the existing ones.

PROOSIS is capable of steady state and transient simulations as well as customer deck generation (dll, exe, ARP4666B, AS4191). Different types of calculations can be performed (single or multi-point design, off-design, test analysis, sensitivity, parametric and optimisation studies, mission analysis, diagnostics, control system design and test, etc).

PROOSIS can also perform multi-fidelity, multi-disciplinary and distributed simulations. These are greatly facilitated by its open architecture, which allows it to connect to external commercial (Excel, Matlab, COM) or in-house tools and link with codes written in C, C++, and FORTRAN.

These features make PROOSIS a useful tool for all phases of the engine life cycle, from preliminary and detailed design to post-certification and in-service support, and allow it to serve as a common framework in multi-partner collaborative engine projects providing common standards and methodologies.

Lastly, PROOSIS also provides a multi-domain simulation platform for the simulation of gas turbines, engine/aircraft systems and power plants.
PROOSIS's ability to model engines relies on its TURBO library. It contains a wide range of components for building performance models for any gas configuration by simply dragging and dropping the required components.

The library, for which the source code is also provided, takes advantage of the object-oriented approach so that it can be easily extended by including new components or customizing the existing ones. Different modelling methods are available for each component, so that the model can fit specific user needs. By means of extendible switch variables, the user can use different correlations for pressure drop, efficiencies, etc.

With the PROOSIS modeling capabilities you can connect the 3D TURBO components to higher fidelity external models for a particular part of the engine (easing, for example) or a 2D or 3D compressor model. Thanks to its compatibility with FORTRAN and C/C++ you can reuse in-house existing codes.

The TURBO library offers a wide range of components for building performance models for any gas configuration. Some of the features of the components are:

- Turbomachinery
- Design and off-design models with MPT and BETA maps (using either pressure ratio or specific enthalpy change)
- Variable number of bleeds. Extracted flow as input, scheduled through a table or user chosen number of bleeds, Impinging flow as input, scheduled through a table or user customized correlation.
- User chosen number of variable bleed entries. Extracted flow as input, scheduled through a table or user customized correlation.
- Different secondary air system configurations can be modeled with the Multipoint calculation wizard and the TURBO library. Several models (Turbojet, different turbofan configurations, turbopropellers, turboshafts, etc.) and calculations (design point and off-design, optimization, parameter estimation, mission simulation, component zooming, dynamic simulation with control system integration, etc.) can be used as templates or starting points for specific user calculations or, together with the book "Introduction to Gas Turbine Modeling with PROOSIS" as educational supporting material.

More complex or atypical calculations can be easily calculated and plotted, as well as the effect of the design parameters on engine performance through the sensitivity calculations.

Design point calculations and performance trends can be easily calculated and plotted, as well as the effect of the design parameters on engine performance through the sensitivity calculations.

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When trying to reproduce a given cycle, the library and PROOSIS provide the flexibility to adjust any cycle input parameter (geometry data, design parameter, flight-operating conditions), adaptation factors to match given performance values.

Cycles meeting different design operating conditions at different flight conditions can be directly calculated with the Multipoint calculation wizard and the PROOSIS engine model. The PROOSIS model can thus be easily simulated together with the control system, developed within PROOSIS (CONTROL library), including different setpoint controllers, protection logic, sensors and actuators for fuel injection, Variable Bleed Valves (VBV) and Variable Geometry Vanes (VGV) developed within PROOSIS (CONTROL library), including different setpoint controllers, protection logic, sensors and actuators for fuel injection, Variable Bleed Valves (VBV) and Variable Geometry Vanes (VGV).

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