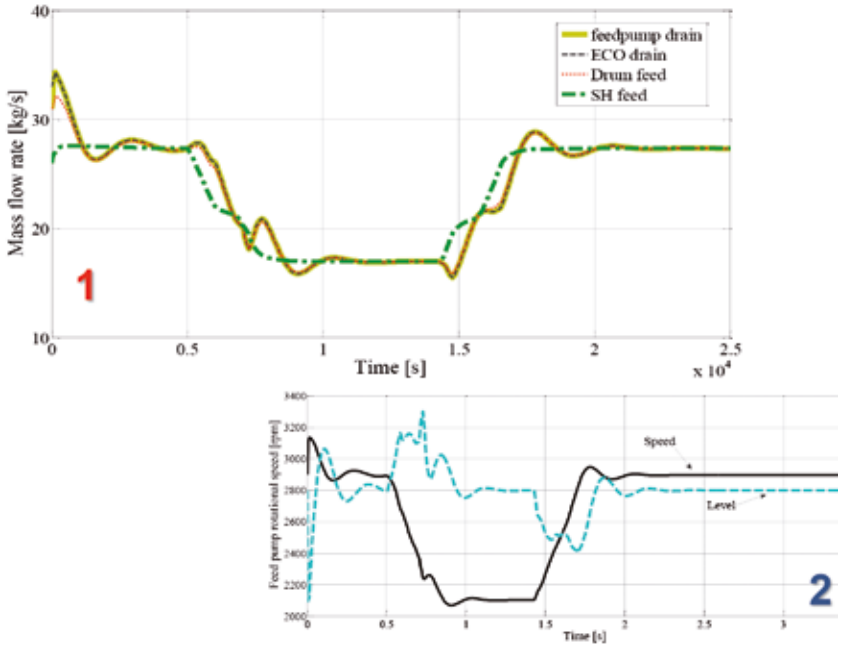
Waste heat recovery technologies for offshore platforms

The deregulated energy market and the increasing quota of electrical capacity covered by non-predictable renewable sources require strongly irregular and discontinuous operation of thermoelectric plants to satisfy users demand and compensate the variability of renewable sources. As a consequence, due to thermo-mechanical fatigue, creep and corrosion, a lifetime reduction of the most critical components occurs.
The availability of a procedure able to predict the residual life of plant devices is necessary to assist the management decisions about power plants' operation and maintenance scheduling. The first step of this procedure is the capability of simulating the plant behaviour versus time by evaluating the trends of the main thermodynamic parameters that describe the plant operation during different transient periods. In this context, the main contribution of the present research is to propose a complete procedure able to simulate the plant dynamic behaviour and estimate the residual life reduction of some components. Indeed, a complex model, developed by means of Modelica modelling language, of a gas steam combined unit is implemented and utilized to characterize the dynamic behaviour of the power plant. The main thermodynamic variables during different transient operation conditions are predicted [Figures 1 and 2].
Moreover, a residual life estimation of the most stressed component is performed. The most stressed point results the inner diameter in the hottest position the of superheater wall. For the load variation from the design point to the technical minimum, the strain corresponds to about 1600 cycles before failure. Considering a management strategy which expects about 200 cycles/year, and adding creep effect, it means a lifetime of 6 years.



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Main research topics:

- Aerodynamic optimization of rotors ofhelicopters and of high efficiency profiles isolated and detached
- Design and management of Pumped Hydro plants
- Design and optimization of hydro and wind turbines (VAWT and HAWT)
- Cavitations, instability and pressure pulse in turbomachinery operating at design and off design load
- Design and management optimization of energy systems by means of multicriteria methods, Life Cycle Assessment (LCA)
- Gas turbines: development of numerical codes for performance provision