AxSTREAM SYSTEM SIMULATION

Modeling a 500 MW Steam Turbine Lubrication System

Case Study Summary

Goals:

Select equipment which will provide the necessary mass flow rate and oil cooling requirements. Accurately design an oil supply pipeline system in AxSTREAM System Simulation

Requirements:

Determine the oil flow rate for thrust, the journal bearings oil supply, and the oil cooling behaviours.

Parameters:

HPC bearings - 300x170 mm
IPC bearings - 420x220 mm
LPC bearings - 520x270 mm
HEX heat transfer area - 193.6 m2
Number of tubes - 1296
Outlet tube diameter - 16x1 mm
Length of tube - 2960 mm

Constraints:

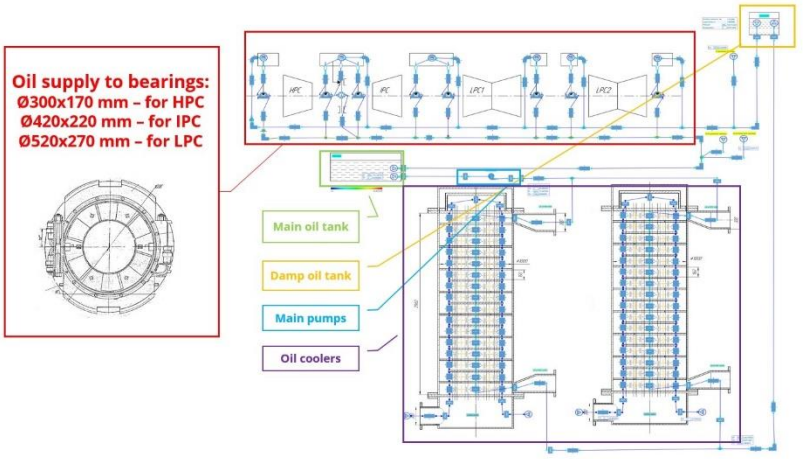
Pwater = 200 kPa
Twater = 33 ºC

Results:

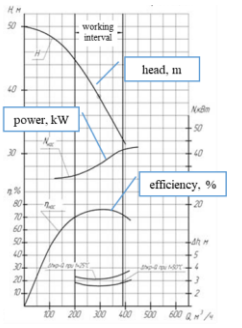
By successfully accounting for the pump characteristics and the oil cooler/bearing properties, an accurate model was built, and the subsequent analysis was completed in as little as 2 minutes. The temperature drops at the heat exchangers and the hydraulic resistance of the system were estimated quickly, allowing for additional analyses and iterations.

Hydraulic Network and Oil Cooler

The lubrication system was built in AxSTREAM System Simulation based on known basic geometric and operating data, including oil cooler properties and material properties.



Oil pump characteristics were specified and added in through a table to simulate off-design conditions for the whole system.



Pump characteristic curves

- Table for dependency of normalized ***head*** from flow rate

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	50	100	150	200	250	290	300	350	400
1.2677484	1.2550709	1.2373225	1.1942190	1.1359026	1.0649087	1	0.9837728	0.8924949	0.8037525

Interpolation: Linear Extrapolation: Linear

- Table for dependency of ***efficiency*** from flow rate

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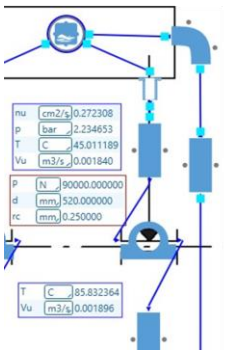
0	50	100	150	200	250	290	300	350	400
0	0.25	0.45	0.6	0.7	0.74	0.756	0.76	0.75	0.705

Interpolation: Linear Extrapolation: Piecewise constant

In addition to using the component library which was done in this study, the user can set up their own scripted methods for completing calculations.



Bearing calculation by ***Codnir method*** in C# script

Advantage: Flexibility to model any component through scripting

Input data:
- Bearing length, mm
- Bearing diameter, mm
- Rotational speed, rpm
- Load, N
- Bearing radial clearance, mm

Calculation results:
- Oil consumption for bearing, m^3/s
- Outlet oil temperature, C