



ORIGINAL ARTICLE

# Comprehensive rotor service life study for high & intermediate pressure cylinders of high power steam turbines



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## KEYWORDS

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Intermediate pressure cylinder (IPC);  
Damage;  
Heat grooves;  
Seals

**Abstract** The paper provides a comprehensive scheme for assessment of the residual service life and extension of operating life of steam turbine rotors with expired fleet service life. The residual service life of high temperature rotors for high & intermediate pressure cylinders of K-200-130-3 steam turbine without heat grooves calculated and it was showed that the residual service life of high & intermediate pressure rotors without grooves has been extended as compared to the K-200-130-1 turbine rotors with grooves. Also residual life management by supplying hot steam to the HPC and IPC seals was investigated and it was noted their significant impact on the residual service life.

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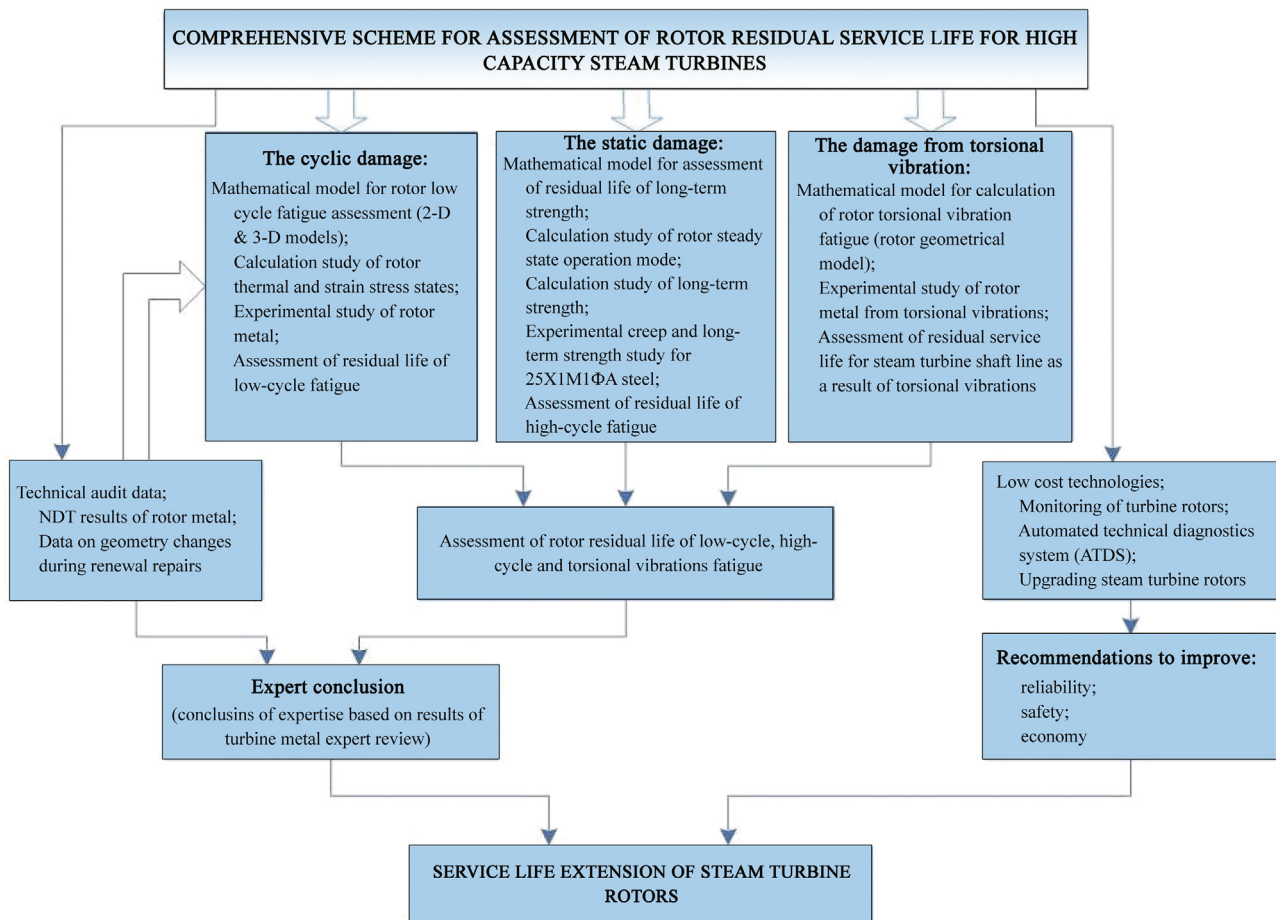
## 1. Introduction

The exhaustion of fleet service life for most of the power equipment is typical for the energy industry of Ukraine. The fleet service life of stationary steam turbines of Ukraine has been exhausted for 90%–100% [1–4]. The capability of justified extension of the

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**Figure 1** Comprehensive scheme for assessment of residual service life of HPC and MPC rotors.

residual service life of operating equipment is a challenging and strategic task, for it enables to significantly reduce costs for commissioning new power capacities.

The solution of the task is connected with implementation of several engineering measures, as well as development of methods and measures to inspect thermal state (TS) and strain stress state (SSS) of the most massive high temperature turbine components. This allows avoiding violation of the acceptable stress values, as well as ensuring start-up and transient operations based on the actual temperature state of the turbine.

Introduction of integrated system of measures aimed at assessing the residual service life and extension of operating life for steam turbine rotors with expired fleet service life makes it possible to extend operating life of equipment without significant increase in expenses. The issues related to extending service life of equipment of thermal (TPP) and nuclear power plants (NPP) with steam parameters of 13–24 MPa and 540–560 °C or replacing this equipment at the same site by a new and more efficient one should be settled based on the feasibility study.

## 2. Comprehensive scheme for assessment of residual service life and extension of operating life

Lifetime extension of the operating power units is the common international practice with primary task aimed at sustaining power production at the attained level prior to commissioning new TPP capacities.

The significant number of operating turbines with expired service life is the specific feature of the modern energy industry. However, the national and foreign practices demonstrate that the actual turbine operating life significantly exceeds the life defined by the manufacturer. The main reason for raising issue on capability to extend the operating life of power plant equipment are several times less expenses required to extend the operating life of high temperature equipment if compared to that needed to purchase new equipment. Under these circumstances one of the most important diagnostics tasks not formally stipulated by the regulations is assessment of the residual service life. This task is not that simple and could not be settled by means of standard studies.

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