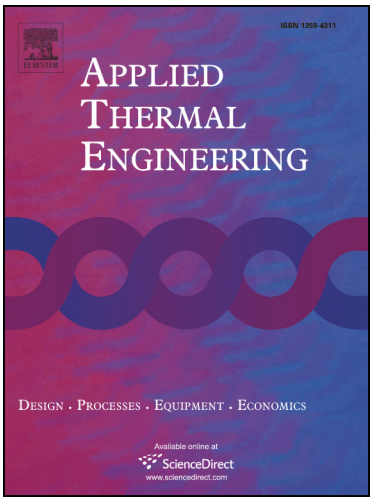

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José Ramón Serrano, Andrés Tiseira, Luis Miguel García-Cuevas, Tatiana Rodríguez Usaquén

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Corresponding author:

Andrés O. Tiseira, CMT – Motores Térmicos. Universitat Politècnica de València. Camino de Vera, s/n. 46022. Valencia, SPAIN.

Phone: + 34 96 387 76 50

Fax: + 34 96 387 76 59

Email: anti1@mot.upv.es

Adaptation of a 1-D tool to study transient thermal in turbocharger bearing housing

José Ramón Serrano, Andrés Tiseira, Luis Miguel García-Cuevas and Tatiana Rodríguez Usaquén

CMT—Motores Térmicos, Universitat Politècnica de València, Camino de Vera s/n, 46022 Valencia, Spain

Abstract

The heat transfer model can be used in a one-dimensional (1-D) engine simulation. When the engine speed is reduced to zero, the codes have been upgraded to calculate transient turbocharger thermal conditions. The turbocharger model has been used as an external plugin. Analysis of the temperature evolution at different parts of the turbocharger is done by using a hot spot engine cycle. A turbocharger bypassing strategy is done by means of a 9 bypass valve system. By using this method, instabilities can be found in the binary on-off state of an engine.

During engine hot-stops, the lack of oil flow inside the turbocharger makes the trapped oil in the bearings burnt as the turbine housing exchanges heat with the central housing. Coke formation can appear and produce big reductions in turbocharger endurance, as bearings clogged and damage the shaft. Several strategies can be used in order to minimize possibilities of coke formation, including an increase in the turbocharger cooling during normal operation and the use of electrically-driven pumps acting after the engine is shut down. These strategies can be simulated in acceptable calculation times thanks to modelling strategy proposed in this paper.

The presented methodology allows a detailed study of the temperature rise of the central housing of an automotive turbocharger after a hot-stop process, simulating several