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## An efficient neural network-based surrogate model for predicting static gear contact conditions

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### ABSTRACT

Gears are an essential component of numerous mechanical systems across a wide range of engineering applications. However, they may be associated to high levels of radiated noise which can limit their use. Accurately predicting this noise is of paramount importance for the design, optimization and health monitoring of gear transmissions. System identification is therefore needed to reach a sufficiently high level of accuracy. However, this usually comes at the cost of high computational burden. Using traditional modeling assumptions, it is widely accepted that the radiated noise stems from the dynamic response of the gears which is itself induced by the static transmission error (STE) and time-varying mesh stiffness. These physical quantities are governed by the local contact conditions between the gear teeth. An accurate computation of these physical quantities is therefore crucial. However, this is a difficult problem as gear contact resolution is intrinsically nonlinear and multiscale. Even considering simplifying assumptions, the computation of this physical quantities entails a significant computational effort when coupled to optimization procedures. In this work, we introduce an efficient neural network-based surrogate model for predicting static gear contact conditions in near real time in order to facilitate the identification and optimization of mechanical systems equipped with geared systems.

*Keywords: Deep learning, Neural networks, Surrogate modeling, Gears*