Subject: PhD at Mondragon University- Machining Laboratory, 3-4 years.

Starting date: from now on (April 2020).

Title: Surface integrity and fatigue strength analysis in environmentally friendly machined components made of steel.

Summary:
The improvement of vehicles safety is a EU priority. The enhancement of the components performance reduces the likelihood of accidents caused by failures of these components. The project aims the improvement of the fatigue and tribological performance of automotive transmission parts by means of an optimized surface integrity reached through innovative finishing techniques. Additionally, some of these techniques will allow the lubricant removal, leading to a 100% eco-friendly process. Complementary, an automatic learning approach, capable of predicting the surface integrity and the fatigue and tribological behaviour, depending on input variables (material properties, process parameters…), will be developed.
The EU is committed to reducing the number of traffic accident victims, as shows the adoption of the proposal in May of 2018. To attain this goal, the first step is to reduce the probability of accidents and, given that component failures is one of the main causes for vehicle accidents, the likelihood of piece failures must be minimised.
Considering that more than 25% of the component failures in vehicles are related to transmission parts, the study to be developed in the project will be focused on two of the main transmission pieces: shafts and gears of the gearboxes.
The main way to reduce the risk of failure is improving the component properties, mainly the fatigue and tribological performance. While shafts are subjected to torsional, bending and biaxial loads, gears support tooth bending loads and pitting. As the maximum stress level caused by these loads is reached at the component surface, the surface properties have a great influence on the component in-service performance. Good tribological performances in terms of wear and friction are expected for both shafts and gears, as they work in sliding contact with counterpart transmission components and SI it's one of the main contributors to fulfil the tribological commitment.
Although during the last years, different finishing operations, alternative to the conventional grinding, have been developed, their industrial implementation has not been faced yet. These promising finishing operations are expected to improve the component surface integrity (SI), leading to a better fatigue and tribological performance. Moreover, most of them can be conducted without lubricant or with a minimum quantity (MQL) resulting in a manufacturing process more eco-friendly than the actual one, in which high amounts of lubricant are used.
The PhD student will carry out the integral study (SI characterization, fatigue and tribological evaluation…) performed in shafts manufactured by novel finishing operations (mainly grinding). Complementary, a machine learning approach will be developed to predict the SI and the fatigue and tribological behaviour of the components, avoiding very expensive and time consuming tests.

Starting degree: Master in Industrial Engineering (to be accredited in Spain)

Lange: English (if possible C1)